

Module unterrichtet an der Humboldt-Universität zu Berlin:

<b>WP1 Säugetierkunde</b>				Studienpunkte: 9
Lern- und Qualifikationsziele: Die Studentinnen und Studenten verfügen über Wissen auf den Gebieten der vergleichenden Säugetieranatomie und der Evolution der Mammalia. Sie haben Einblick in verschiedene Präparationstechniken, Methoden der Freilandarbeit und Museumsarbeit.				
Voraussetzungen für die Teilnahme am Modul: keine				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	Vertiefung morphologischer Kenntnisse am Säugetierschädel und am postcranialen Skelett, Vertiefung der Kenntnisse der Systematik und Evolution von Säugetieren, Fang und Präparationstechniken von Säugetieren, Einführung in museologische Aspekte
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP, Referat im Umfang von 30 Minuten	Erweiterung der Inhalte der Vorlesung und des Praktikums durch zusätzliche Seminarthemen zur Biologie von Kleinsäugetern und / oder zu ausgewählten Ökosystemen mit speziellem Bezug auf dort vorkommende Säugetierarten (alle 2 Jahre als Voraussetzung für weiterführende vierzehntägige Exkursion)
Praktikum	3	<u>135 Stunden</u> 45 Stunden Präsenz; 90 Stunden Selbststudium im Sinne des § 5 Abs. 2	4,5 SP	Vertiefung der Kenntnisse in der Determination von Säugetierarten, Dokumentation von Schädelmerkmalen, Kenntnis von Präparationstechniken, Exkursion nach Brandenburg zum Kennenlernen von Fangmethoden im Feld Exkursion: Einführung in säugetierkundliche Methoden im Feld und im Labor
Modulabschlussprüfung			Bestehen	schriftliche Klausur (60-90 Minuten) oder mündliche Prüfung (20 Minuten) über Inhalte der Vorlesung und des Praktikums
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		
Lehrende		Prof. Dr. Ulrich Zeller <a href="mailto:Ulrich.Zeller@mfn-berlin.de">Ulrich.Zeller@mfn-berlin.de</a> Dipl.-Biol. Th. Göttert, Dipl.-Biol. S. Siniza, Dipl.-Biol. M. Wicke, Dr. K. Ferner		

<b>WP 2 Vertebrate Adaption to Xeric Environments</b>				Studienpunkte: 9
Lern- und Qualifikationsziele: Die Studierenden besitzen Kenntnisse über die ökologische Plastizität von Vertebraten in Anpassung an die Komplexität von ariden und semiariden Gebieten. Studenten haben Kompetenzen in der Einordnung der vielfältigen Adaptionen (Organsysteme, Physiologie, Verhalten, Reproduktion) der Vertebraten an diese Ökosysteme und besitzen Methodenkompetenzen um wissenschaftliche Fragestellungen eigenständig bearbeiten, auswerten und darstellen zu können.				
Voraussetzungen für die Teilnahme am Modul: keine				
Lehr- und Lernformen	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	-Einführung in die Trockengebiete der Erde und generelle Eigenschaften dieser -Darstellung und systematische Einordnung wichtiger Wirbeltiergruppen in Trockenbiotopen -generelle Anpassungen von Vertebraten an Wüstengebiete (Anatomie der Organsysteme, Nahrung, Reproduktion, Physiologie, Verhalten) -spezielle Beispiele ausgesuchter Vertebraten und ihre Adaptionen -Biodiversität arider Gebiete -evolutionäre Aspekte der Anpassung von Vertebraten an aride Ökosysteme
Praktikum	3	<u>135 Stunden</u> 45 Stunden Präsenz; 90 Stunden Selbststudium im Sinne des § 5 Abs. 2	4,5 SP Anfertigung des Protokoll	Behandlung ausgewählter Wirbeltiere arider Ökosysteme mit praktischen Übungen und Demonstrationen: Verbreitung, Funktionsmorphologie, Lebensweise... anhand von Material des Naturkundemuseum Berlin Exkursion in den Zoo Berlin oder Tierpark Berlin mit dem Schwerpunkt Physiognomie und Verhalten von Wirbeltieren,
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP Referat im Umfang von 30 Minuten	Vertiefung der Inhalte der Vorlesung durch Studium von Originalliteratur: Vorträge und Diskussionen zu ausgewählten Aspekten der Vertebratenanpassungen an aride Gebiete
Modulabschlussprüfung			Bestehen	schriftliche Klausur (90 Minuten, 100%) oder mündliche Prüfung (20 Minuten, 100%)
Lehrender		Prof. Dr. Ulrich Zeller <a href="mailto:Ulrich.Zeller@mfn-berlin.de">Ulrich.Zeller@mfn-berlin.de</a> Dipl.-Biol. Th. Göttert		
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input checked="" type="checkbox"/> WS <input checked="" type="checkbox"/> SS		

<b>WP 3 Funktionelle Biodiversität arider und semiarider Ökosysteme</b>				Studienpunkte: 9
<p>Lern- und Qualifikationsziele:  Die Teilnehmenden erwerben in diesem Modul eine Wissensvertiefung in Hinblick auf Wüstenbildung (Desertifikation) und Management natürlicher Ressourcen in Bezug auf Erhalt der Biodiversität.  Sie erwerben folgende Kenntnisse und Fähigkeiten:</p> <ul style="list-style-type: none"> <li>- Verständnis für Dynamiken natürlicher Ressourcen für Organismen in ariden Gebieten</li> <li>- vertiefte Kenntnisse über Ökophysiologische Bedingungen und Prozesse</li> <li>- Spezialkenntnisse zur Ökologie arider Ökosysteme</li> <li>- Fähigkeit, natürliche Prozesse, die auf Biodiversitätsmuster wirken, zu erklären</li> <li>- Hintergrundwissen zum Management natürlicher Ressourcen durch den Menschen</li> <li>- Fähigkeit, Möglichkeiten für nachhaltige Entwicklung in ariden Gebieten zu diskutieren</li> </ul>				
Voraussetzungen für die Teilnahme am Modul: <i>keine</i>				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit, 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP schriftliche Abschlussprüfung	Einführung in aride Landschaften der Erde und Namibia, geografischer und klimatologischer Hintergrund, Schwerpunkt Namib Wüste Ökophysiologie unter Bedingungen von Wasserknappheit, Nahrungsmittel-Limitierung und Hitze: Quellen, Limitierung, Zeit-Raum-Fenster Wüsten-Ökologie und Biodiversität in Wüsten Management natürlicher Ressourcen im Wüstenhabitat Desertifikation
SE	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit, 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP, Hausarbeit mit mündlicher Präsentation	- Optionale Integration eines 2-Tages-Seminars mit dem Schwerpunkt auf spezifischen Problemen einer anderen ariden Region (Landdegradierung, Desertifikation in der Sahel)
EX	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit, 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP, Teilnahme, Abschlussbericht	- Besuch der Gobabeb Research Station
Modulabschlussprüfung			Bestehen	Schriftliche Modulabschlussprüfung (180 Min) = 60% Hausarbeit und mündliche Präsentation = 30% Abschlussbericht Exkursion = 10 %
Dauer des Moduls	<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester			
Beginn des Moduls	<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS			

Lehrende	Dr. J. Henschel <a href="mailto:gobabeb@gobabeb.org">gobabeb@gobabeb.org</a>
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<b>WP 4 Landwirtschaft und Gartenbau in Ballungszentren</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: - besitzen Kenntnisse über die Besonderheiten von urbaner Landwirtschaft und Gartenbau - können spezifische Unterschiede in urbaner Landwirtschaft und Gartenbau in unterschiedlichen Klimaregionen und gesellschaftliche Bedingungen einordnen - erwerben Kenntnisse zu pflanzenphysiologischen Reaktionen auf urbane Stressoren im Hinblick auf das Produktions- und Qualitätsmanagement				
Voraussetzungen für die Teilnahme am Modul: <i>keine</i> , empfohlen: Pflanzenbau, Pflanzenphysiologie				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	- Darstellung der Zusammenhänge zwischen Produktionsprozessen und Ressourcennutzung in Ballungszentren - Stadtökologische Parameter und deren Einfluss auf das Prozess- und Qualitätsmanagement in urbaner Landwirtschaft und Gartenbau - Urbane landwirtschaftliche und gärtnerische Produktion in Abhängigkeit von Klimazonenspezifischen Eigenheiten und dem gesellschaftlichen Kontext (Entwicklungsländer, Industrieländer)
EX	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Modulabschlussprüfung			Bestehen	Projektbericht 10 Seiten (50%) und mündliche Verteidigung 15 Minuten (50%)
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input checked="" type="checkbox"/> WS <input type="checkbox"/> SS		
Lehrende		Prof. Ch. Ulrichs, <a href="mailto:christian.ulrichs@agrar.hu-berlin.de">christian.ulrichs@agrar.hu-berlin.de</a> PD Dr. H. Hoffmann,		

<b>WP 5 Evolutionäre Morphologie der Wirbeltiere</b>				Studienpunkte: 9
Lern- und Qualifikationsziele: Die Studentinnen und Studenten besitzen Kenntnisse auf den Gebieten der vergleichenden Anatomie, Morphologie, Ökologie, Paläontologie und Evolution der Wirbeltiere. Exkursionen und Arbeiten an rezenten und fossilen Objekten vermitteln Fähigkeiten der vergleichenden Beobachtung und Analyse.				
Voraussetzungen für die Teilnahme am Modul: keine				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	Systematik und Evolution der Wirbeltiere: Darstellung wichtiger Wirbeltiergruppen auf evolutionsbiologischer Grundlage, Phylogenie, Anatomie, Ontogenie, Funktionsmorphologie, Lebensweise, Fossilgeschichte
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP, Referat im Umfang von 30 Minuten	Vertiefung der Inhalte der Vorlesung durch Studium von Originalliteratur: Vorträge und Diskussionen zu klassischen und modernen Problemfeldern in der Evolutionsbiologie der Wirbeltiere
Praktikum	3	<u>135 Stunden</u> 45 Stunden Präsenz; 90 Stunden Selbststudium im Sinne des § 5 Abs. 2	4,5 SP Anfertigung des Protokoll	Bauplan der Wirbeltiere Behandlung ausgewählter rezenter und fossiler Wirbeltiere mit praktischen Übungen und Demonstrationen: basale Chordata, paläozoische Gnathostomata, Anatomie und Evolution der Fische, vergleichende Osteologie der Tetrapoden, Anatomie des Menschen aus evolutionsbiologischer Sicht Exkursion: Besuch des Zoologischen Gartens oder des Tierparks Friedrichsfelde zur Abschlussbetrachtung der Themenkomplexe am lebenden Objekt. Funktionelle Morphologie aquatischer und terrestrischer Wirbeltiere, Einführung in die spezielle Tierhaltung:
Modulabschlussprüfung			Bestehen	schriftliche Klausur (90 Minuten, 100%) oder mündliche Prüfung (20 Minuten, 100 %)
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input checked="" type="checkbox"/> WS <input type="checkbox"/> SS		
Lehrende		Prof. Dr. Ulrich Zeller <a href="mailto:ulrich.Zeller@mfn-berlin.de">ulrich.Zeller@mfn-berlin.de</a> Dipl.-Biol. Th. Göttert, Dipl.-Biol. S. Siniza, Dr. K. Ferner		

<b>WP 6 Ökologischer Landbau</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Kenntnisse und Fähigkeiten zur Gestaltung von Produktionsverfahren in ökologisch wirtschaftenden Betrieben				
Voraussetzungen für die Teilnahme am Modul: keine				
Lehr- und Lernfor m	Präsen z-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	3,5	<u>150 Stunden</u> 50 Stunden Präsenzzeit; 100 Stunden Selbststudium im Sinne des § 5 Abs. 2	5 SP	<ul style="list-style-type: none"> <li>- Merkmale des Bewirtschaftungssystems ÖLB einschl. unterschiedlicher Leitbilder</li> <li>- Rechtliche und organisatorische Rahmenbedingungen des ÖLB in Deutschland und Europa</li> <li>- Nährstoffmanagement, Bodenbearbeitung,</li> <li>- Fruchtfolgen, Unkrautkontrolle und Pflanzenschutz in viehlosen und Viehhaltenden Öko-Betrieben</li> <li>- Anbauverfahren für einzelne Kulturarten im ÖLB</li> <li>- Einbeziehung landschaftsökologischer Aspekte in die Produktion</li> </ul>
EX	0,5	<u>30 Stunden</u> 10 Stunden Präsenzzeit; 20 Stunden Selbststudium im Sinne des § 5 Abs. 2	1 SP	
Modulabschlussprüfung			Bestehen	Klausur 90 Minuten oder Hausarbeit (10 Seiten, 50%) und Vortrag (15 Minuten, 50%)
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		
Lehrende		PD Dr. H. Hoffmann, <a href="mailto:heide.hoffmann@agrar.hu-berlin.de">heide.hoffmann@agrar.hu-berlin.de</a>		





<b>WP 7 Spezielle Aspekte des ökologischen Landbaus</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Kenntnisse und Fähigkeiten zur Prozessführung und Prozesskontrolle im Ökologischen Landbau (oder ÖLB)				
Voraussetzungen für die Teilnahme am Modul: keine, empfohlen: Module Acker- und Pflanzenbau, Standortkunde, Pflanzenernährung, Pflanzenschutz, Agrartechnik				
Lehr- und Lernform	Präsenz -SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	Merkmale sowie rechtliche und organisatorische Rahmenbedingungen des ÖLB im internationalen Kontext - Nährstoffmanagement im ÖLB - Unkraut- und Schaderregerregulierung im ÖLB
ÜB	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	
EX	-	-	-	Teilnahme fakultativ
Modulabschlussprüfung			Bestehen	Mündliche Prüfung 30 Minuten (100%), oder Hausarbeit 10 Seiten (50%) und Vortrag 15 Minuten (50%)
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input checked="" type="checkbox"/> WS <input type="checkbox"/> SS		
Lehrende		PD Dr. H. Hoffmann, <a href="mailto:heide.hoffmann@agrار.hu-berlin.de">heide.hoffmann@agrار.hu-berlin.de</a> , PD Dr. St. Kühne(BBA Kleinmachnow), Prof. Ch. Engels		

<b>WP 8 Wirkstoffpflanzen</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Die Studierenden - können Entwicklung und wirtschaftlichen Bedeutung des Anbaus von Arznei-, Gewürz-, Duft- und Farbstoffpflanzen beurteilen - kennen die sekundären Inhaltsstoffgruppen - haben Kenntnisse zu den wichtigsten in Deutschland angebauten Arznei-, Gewürz- und Farbstoffpflanzen - verfügen über Kenntnisse zu Qualitätsbewertung der Rohstoffdrogen, - kennen Prozessgestaltung zur Qualitätssicherung - sind über aktuelle Forschung und Entwicklung informiert				
Voraussetzungen für die Teilnahme am Modul: keine, empfohlen: Acker- und Pflanzenbau, Bodenkunde, Düngung				
Lehr- und Lernform	Präsenz -SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	3	<u>135 Stunden</u> 45 Stunden Präsenzzeit; 90 Stunden Selbststudium im Sinne des § 5 Abs. 2	4,5 SP	- Wirtschaftliche Entwicklung und Bedeutung von Arznei-, Gewürz-, Aroma- und Farbstoffpflanzen - Inhaltsstoffgruppen / Wirkstoffe, aktuelle Entwicklungen in der Forschung - Vorkommen, Verbreitung, Botanik, Wirkungs- und Anwendungsgebiete von Wirkstoffpflanzen - Besonderheiten des Anbaus, Ernte und Aufbereitung wichtiger Arznei-, Gewürz und Farbstoffpflanzen - Qualitätsmerkmale, Qualitätsprüfung, Qualitätssicherung  Literaturhinweise: - Kurs in Lernplattform „MOODLE“ für Acker- und Pflanzenbau - Kurs in Lernplattform „MOODLE“ für Arznei- und Gewürzpflanzen
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP, Studienleistung: Seminarvortrag	
Modulabschlussprüfung			Bestehen	Klausur 90 Minuten (100%), Vorleistung: Seminarvortrag
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		
Lehrende		PD Dr. R. Schenk <a href="mailto:regina.schenk@agrar.hu-berlin.de">regina.schenk@agrar.hu-berlin.de</a>		

<b>WP 9 Hydroponische Systeme im Gartenbau</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Die Studierenden: – kennen die verschiedenen hydroponischen Verfahren – sind in der Lage diese Verfahren für die entsprechenden Pflanzenarten zu projektieren – können die physikalischen und chemischen Eigenschaften von Substraten bestimmen – sind in der Lage den Bedarf an Wasser und Nährstoffen zu ermitteln – haben Kenntnis über die Messung der wichtigsten chemischen Parameter in Nährlösungen				
Voraussetzungen für die Teilnahme am Modul: keine, empfohlen: Gärtnerische Nutzpflanzen				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	3	<u>135 Stunden</u> 45 Stunden Präsenzzeit, 90 Stunden Selbststudium im Sinne des § 5 Abs. 2	4,5 SP	– Definition und Prinzipien von hydroponischen (soilless) Systemen für gärtnerische Kulturen, – Technische Charakteristik und technologische Systeme in der Hydroponik wie Substratkultur, Wasserkultur und Aeroponik, – Substrate, deren Nutzungseigenschaften und ihre Standardisierung – Berechnung des Wasser- und Nährstoffbedarfs für verschiedene hydroponische Verfahren – Kultivierung ausgewählter gärtnerischer Kulturen (Gemüse, Zierpflanzen, Kräuter etc.) in der Hydroponik
Übung	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit, 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP, Vorleistung: Übungsprotokolle	
Modulabschlussprüfung			Bestehen	Mündliche Prüfung 30 Minuten (100%), Vorleistung: Übungsprotokolle
Dauer des Moduls	<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester			
Beginn des Moduls	<input checked="" type="checkbox"/> WS <input type="checkbox"/> SS			
Lehrende	Doz. Dr. Dr. Böhme, Michael <a href="mailto:michael.boehme@rz.hu-berlin.de">michael.boehme@rz.hu-berlin.de</a>			

<b>WP 10 Pflanzenernährung in verschiedenen Naturräumen</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Aufbauend auf einem Verständnis der pflanzlichen Mechanismen zur Aneignung und Verwertung von Mineralstoffen sind die Studierenden in der Lage, eine mögliche Limitierung des Pflanzenwachstums durch Nährstoffe, Wasser oder andere Umweltfaktoren unter spezifischen Standortbedingungen zu erkennen, Maßnahmen zur Vermeidung von Wachstumsstörungen zu entwickeln und damit zur Mitigation von Klimaänderungen beizutragen.				
Voraussetzungen für die Teilnahme am Modul: keine, empfohlen: Module Bodenkunde, Anbausysteme, Pflanzenernährung und Düngung				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	3	<u>135 Stunden</u> 45 Stunden Präsenzzeit; 90 Stunden Selbststudium im Sinne des § 5 Abs. 2	4,5 SP	<ul style="list-style-type: none"> <li>- Mineralstoffumsatz im Kreislauf Boden/ Pflanze unter verschiedenen standörtlichen Bedingungen (Klima, Böden, Anbausystemen)</li> <li>- Nährstofflimitierung unter verschiedenen Standortbedingungen und Anpassungsreaktionen der Pflanzen (Aufnahme- und Verwertungseffizienz für Mineralstoffe)</li> <li>- Einfluss veränderter Umweltbedingungen (Luftschadstoffe, Temperatur, Niederschlag) auf das Wachstum und die Mineralstoffernährung der Pflanzen</li> </ul>
Übung	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Modulabschlussprüfung			Bestehen	Mündliche Prüfung 30 Minuten oder schriftliche Hausarbeit 20 Seiten
Dauer des Moduls	<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester			
Beginn des Moduls	<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS			
Lehrende	Prof. E. George <a href="mailto:george@igzev.de">george@igzev.de</a> , Prof. Ch. Engels, Dr. E. Neumann			

<b>WP 11 Weidemanagement</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Die Studierenden <ul style="list-style-type: none"> <li>- sind befähigt, die Weide als spezielle Grünlandnutzungsform zu bewerten (Produktions- und Landschaftspflegeziele)</li> <li>- kennen die Wechselwirkungen zwischen Weidenarbe und Weidetieren</li> <li>- verfügen über spezielle Kenntnisse zum Herdenmanagement verschiedener Nutztierarten</li> <li>- sind zur Organisation und technischen Umsetzung von Weideverfahren mit verschiedenen Tierarten befähigt</li> </ul>				
Voraussetzungen für die Teilnahme am Modul: keine, empfohlen: Modul Grünland- und Futterbaumanagement				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden [Erläuterung: Ein SP entspricht 25 Zeitstunden.]	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	<ul style="list-style-type: none"> <li>- Grundlagen zur Charakterisierung von Weidestandorten und ihrer Ertragspotenziale</li> <li>- Zusammenhänge zwischen Standort, Bewirtschaftung und Weidefutterwuchs, Wechselwirkungen zwischen Weidetier und Weidenarbe (Einfluss von Tritt, Verbiss; Tierverhalten, Nährstoffkreisläufe)</li> <li>- Herdenmanagement in Abhängigkeit von Tierart und Bewirtschaftungsintensität</li> <li>- Weideeinrichtungen und -ausrüstungen</li> <li>- Kalkulation von Modellen zur Weidefuttermittelsversorgung</li> </ul> Literaturhinweise: <ul style="list-style-type: none"> <li>- Grünlandlehre. (W. Opitz v. Boberfeld, Ulmer Verlag, 1994)</li> <li>- Zeitgemäße Grünlandbewirtschaftung. (K. Buchgraber, G. Grindl, L. Stocker Verlag, 2. Aufl. 2004)</li> </ul>
ÜB	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
EX	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Modulabschlussprüfung			Bestehen	mündliche Prüfung (30 Minuten)
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		

Lehrende	Dr. H. Giebelhausen <a href="mailto:hermann.giebelhausen@agrar.hu-berlin.de">hermann.giebelhausen@agrar.hu-berlin.de</a> Dr. M. Krockner <a href="mailto:manfred.krockner@agrar.hu-berlin.de">manfred.krockner@agrar.hu-berlin.de</a>
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<b>WP 12 Qualitätssicherung pflanzlicher Produkte</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Die Studierenden - haben Kenntnisse über die wesentlichen Qualitätsparameter und sind in der Lage die Qualität pflanzlicher Nahrungsmittel für die vorgesehene Verwendung zu beurteilen - besitzen Kenntnisse über die Methoden der Qualitätsbestimmung und Qualitätsbewertung pflanzlicher Produkte - haben Kenntnisse über die wichtigsten Aufbereitungsverfahren und industriellen Verarbeitungsprozesse pflanzlicher Rohstoffe und deren besondere Qualitätsanforderungen - sind in der Lage, Qualitätsmanagementsysteme in der Landwirtschaft und kritisch zu bewerten - sind befähigt, Anbauverfahren landwirtschaftlicher Nutzpflanzen im Hinblick auf qualitätsausbildende Parameter und industrielle Qualitätsanforderungen kritisch zu bewerten				
Voraussetzungen für die Teilnahme am Modul: keine, empfohlen: Module Prozessführung im Pflanzenbau				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	-spezifische Qualitätseigenschaften wichtiger landwirtschaftlicher Nutzpflanzen (Getreide, Zuckerrüben, Mais, Kartoffeln, ausgewählte Sonderkulturen) für industrielle Verarbeitungsprozesse -Bewertung von Anbauverfahren zur Erzeugung besonderer Produktqualitäten für die industrielle Verarbeitung - Qualitätsrelevante gesetzliche Regelungen auf nationaler und internationaler Ebene - Lagerschäden durch Krankheiten und Schädlinge sowie Maßnahmen zur Prophylaxe und Bekämpfung - Toxikologische Aspekte von Pflanzenkrankheiten
SE	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	
Übung	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Modulabschlussprüfung			Bestehen	Hausarbeit 20 Seiten (100%), Vorleistung: Protokolle 10 Seiten
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		
Lehrende		PD Dr. R. Schenk, <a href="mailto:regina.schenk@agrار.hu-berlin.de">regina.schenk@agrار.hu-berlin.de</a> Prof. F. Ellmer, Dr. M.Goßmann, Dr. K. Weiß		

<b>WP 13 Landnutzungssysteme für Gärtnerische Nutzpflanzen</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Die Studierenden kennen die Systeme der Landnutzung für gärtnerische Nutzpflanzen sind in der Lage Fruchtfolge und Anbauplanung für gärtnerische Nutzpflanzen durchzuführen haben Kenntnisse zur standortgerechten Gestaltung der technologischen Produktionsprozesse für gärtnerische Nutzpflanzen sind in der Lage Einflüsse auf das Ertragspotential zu analysieren und erforderliche Aktivitäten zu planen				
Voraussetzungen für die Teilnahme am Modul: keine				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 45 Stunden Präsenzzeit; 90 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	Systeme der Landnutzung und der Produktion gärtnerischer Nutzpflanzen insbesondere im Gemüse- und Obstbau Formen der integrierten und ökologischen Produktionsweise beim Gemüse- und Obstbau Fruchtfolge und Anbauplanung für ein- und mehrjährige gärtnerische Nutzpflanzen Gestaltung technologischer Abläufe und Prozesse bei gärtnerischen Nutzpflanzen und Maßnahmen der Qualitätssicherung (Standortvorbereitung, Düngung, Einsatz von Komposten, Bestellung, Pflege, Ernte) Gestaltung der Wachstumsfaktoren bei der Kultivierung von gärtnerischen Nutzpflanzen Faktoranalyse und Systemsteuerung zur Ausnutzung des Ertragspotentials
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Übung	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Modulabschlussprüfung			Bestehen	Seminarvortrag 10 Minuten (40 %) mündliche Prüfung 20 Minuten (60 %)
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		



Lehrende	Doz. Dr. Dr. Böhme, Michael <a href="mailto:michael.boehme@rz.hu-berlin.de">michael.boehme@rz.hu-berlin.de</a>
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<b>WP 14 Kultivierung von Gemüse in den Tropen und Subtropen</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Die Studierenden kennen die Wachstumsbedingungen für Gemüse in den Tropen und Subtropen sind in der Lage Produktionssysteme für Gemüse entsprechend der Standorte zu entwickeln kenne die wichtigsten Gemüsearten der Tropen und Subtropen sind in der Lage technologische Abläufe der Produktion und Qualitätssicherungsmaßnahmen zu formulieren				
Voraussetzungen für die Teilnahme am Modul: Moodle Lernmanagementsystem				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	Geographische und klimatische Beschreibung der tropischen und subtropischen Regionen Edaphische und klimatische Anbaubedingungen für Gemüse in den verschiedenen Regionen Landnutzungs- und Produktionssysteme für Gemüse in tropisch/subtropischen Gebieten Ernährungsphysiologische und wirtschaftliche Bedeutung der wichtigsten subtropischen und tropischen Gemüsearten und ihrer Produktionsmethoden Diagnostizierung des Wachstums von subtropischen und tropischen Gemüsearten Grundsätze der Vermehrung von subtropischen und tropischen Gemüsearten einschließlich biotechnologischer Methoden und ausgewählte Züchtungsmethoden
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Übung	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Modulabschlussprüfung			Bestehen	Protokolle ca. 10 Seiten (20 %) mündliche Prüfung 20 Minuten (80 %)
Dauer des Moduls	<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester			

Beginn des Moduls	<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS
Lehrende	Doz. Dr. Dr. Böhme, Michael, Dr. I. Pinker <a href="mailto:michael.boehme@rz.hu-berlin.de">michael.boehme@rz.hu-berlin.de</a>

<b>WP 15 Einfluss der Pflanzenernährung und anderer Außenfaktoren auf die Zusammensetzung und die Qualität von Gemüse und Zierpflanzen</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Die Studierenden verstehen die pflanzenphysiologische Bedeutung von Mineralstoffen Die Studierenden verstehen den Einfluss von Außenbedingungen auf die Zusammensetzung und die Qualität der Pflanze Die Studierenden können neue gartenbauliche Systeme entwerfen, die zur Produktion hochwertiger Gemüse- und Zierpflanzen besonders geeignet sind				
Voraussetzungen für die Teilnahme am Modul: keine				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	- Funktion der Mineralstoffe im Stoffwechsel der Pflanze - Einfluss der Pflanzenernährung und anderer Außenfaktoren auf die Zusammensetzung, den Geschmack und die Qualität von Pflanzen
Praktikum	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	mit Exkursion
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Modulabschlussprüfung			Bestehen	Mündliche Prüfung 20 Minuten oder Seminarvortrag 20 Minuten
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		
Lehrende		Prof. Dr. Eckhard George, Prof. Dr. Christof Engels, Dr. Bernhard Brückner (IGZ) Dr. Angelika Krumbein (IGZ), Dr. Uwe Drüge (IGZ), Dr. Elke Neumann (IGZ) <a href="mailto:george@igzev.de">george@igzev.de</a>		

<b>WP 16 Pflanzenernährung und Nährstoffversorgung in umweltfreundlichen gartenbaulichen Anbausystemen</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: Die Studierenden verstehen die Umwelteffekte von Düngung und gartenbaulichen Produktionssystemen Die Studierenden verstehen Elementkreisläufe in und Energiebilanzen von gartenbaulichen Produktionssystemen Die Studierende können neue gartenbauliche Systeme entwerfen, die geringe Nährstoff und Energieansprüche haben				
Voraussetzungen für die Teilnahme am Modul: keine				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	4,5 SP	Umweltnutzen und Umweltkosten der Düngung in gartenbaulichen Anbausystemen - Düngung, Photosynthese und Kohlenstoffbilanzen - Energieeffiziente gartenbauliche Anbausysteme und intelligente Pflanzenernährung - Pflanzenernährung im ökologischen Gartenbau
SE	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	
Praktikum	1	<u>45 Stunden</u> 15 Stunden Präsenzzeit; 30 Stunden Selbststudium im Sinne des § 5 Abs. 2	1,5 SP	mit Exkursion
Modulabschlussprüfung			Bestehen	Mündliche Prüfung 20 Minuten oder Seminarvortrag 20 Minuten
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		

Lehrende	Prof. Dr. Eckhard George, Prof. Dr. Christof Engels, Dr. Bernhard Brückner (IGZ) Dr. Angelika Krumbein (IGZ), Dr. Uwe Drüge (IGZ), Dr. Elke Neumann (IGZ) <a href="mailto:george@igzev.de">george@igzev.de</a>
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<b>WP 17 Tropical Fish Communities</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: The students learn about - ecology and zoogeography of tropical freshwater fish - systematics of primary and secondary fishes - characteristics of tropical fish communities - periodicity of life cycles in the tropics - overviews about aquaculture systems in the tropics and subtropics - resources for tropical and subtropical aquaculture - sustainability of tropical and subtropical aquaculture systems - socioeconomy of tropical and subtropical aquaculture				
Voraussetzungen für die Teilnahme am Modul: none, recommended: modules Limnology, Biology, Ecology				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
VL	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	- ecology and zoogeographic of tropical fish species - systematic of primary and secondary tropical fish species - characteristics of tropical fish communities - periodicity of life cycles in the tropics - overview about aquaculture systems in the tropics and subtropics - resources for tropical and subtropical aquaculture - sustainability of tropical and subtropical aquaculture systems - socioeconomy of tropical and subtropical aquaculture
SE	2	<u>90 Stunden</u> 30 Stunden Präsenzzeit; 60 Stunden Selbststudium im Sinne des § 5 Abs. 2	3 SP	
Modulabschlussprüfung				Oral Exam 30 minutes (100%)
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input checked="" type="checkbox"/> WS <input type="checkbox"/> SS 4 semester rotation		
Lehrende		Prof. Dr. F. Kirschbaum <a href="mailto:frank.kirschbaum@staff.hu-berlin.de">frank.kirschbaum@staff.hu-berlin.de</a> Dr. A. Müller-Belecka <a href="mailto:andreas.mueller-belecka@ifb-potsdam.de">andreas.mueller-belecka@ifb-potsdam.de</a>		

<b>WP 18 Gender and Globalization</b>				Studienpunkte: 6
Lern- und Qualifikationsziele: <ul style="list-style-type: none"> <li>- Knowledge on gender analysis</li> <li>- Knowledge on concepts of political economy, state theory and global governance</li> <li>- Ability to reflect these concepts from a gender perspective</li> <li>- Ability to analyze the gendered effects of economic globalization</li> <li>- Ability to identify the intersectionality between gender, class and ethnicity in globalization processes</li> </ul>				
Voraussetzungen für die Teilnahme am Modul: none				
Lehr- und Lernform	Präsenz-SWS	Workload in Stunden	Studienpunkte und Voraussetzung für deren Erteilung	Themen, Inhalte
SE	2	<u>180 Stunden</u> 60 Stunden Präsenzzeit; 120 Stunden Selbststudium im Sinne des § 5 Abs. 2	6 SP Presentation and seminar paper writing	<ul style="list-style-type: none"> <li>- Introduction to feminist theories of globalization and political economy</li> <li>- Conceptual underpinnings of global economic restructuring</li> <li>- Impacts of globalization on migration and natural resources</li> <li>- Transformation of gender orders in the course of globalization</li> <li>- The role of the state and of International Organizations in globalization processes</li> <li>- Transnational feminist activism and women's economic and social rights</li> </ul>
Modulabschlussprüfung				Oral presentation and discussion; seminar paper
Dauer des Moduls		<input checked="" type="checkbox"/> 1 Semester <input type="checkbox"/> 2 Semester		
Beginn des Moduls		<input type="checkbox"/> WS <input checked="" type="checkbox"/> SS		
Lehrende		Prof. Dr. Christine Bauhardt <a href="mailto:christine.bauhardt@gender.hu-berlin.de">christine.bauhardt@gender.hu-berlin.de</a> Dr. Gülay Caglar <a href="mailto:guelay.caglar@gender.hu-berlin.de">guelay.caglar@gender.hu-berlin.de</a>		



Module unterrichtet an der Texas Tech University:

<b><u>Required Courses</u></b>	<b><u>Theme</u></b>	<b><u>Page</u></b>	<b><u>Instructor CV</u></b>
CE 5366 Water Resources Management	DW	2	Dr. Ken Rainwater
GEOG 5306 Seminar in Geography of Arid Lands	DE	3	Dr. Jeff Lee
NRM 5317 Watershed Management	DD	4	Dr. Ernest Fish
<b><u>Elective Courses</u></b>			
AAEC 5314 Environmental Economics and Policy Analysis	DD	6	Dr. Jeff Johnson
AGSC 5303 Ecology of Grazing Lands Systems	DE	8	Dr. Vivian Allen
ATMO 5302 Weather, Climate, and Applications	DE	10	Dr. Colleen Ann Leary
BIOL 5330 Advanced Landscape Ecology	DE	12	Dr. Nancy E. McIntyre
CE 5361 Surface Water Hydrology	DW	13	Dr. Ted Cleveland
CE 5363 Groundwater Hydrology	DW	14	Dr. Ken Rainwater
CE 5364 Groundwater Transport Phenomena	DW	16	Dr. Ken Rainwater
CE 5394 Natural Systems for Wastewater Treatment	DW	17	Dr. Clifford B. Fedler
ENTX 6361 Environmental and Wildlife Toxicology	DE	19	Dr. Phil Smith
ENTX 6371 Procedure & Techniques in Ecological Risk Assessment	DE	21	Dr. Phil Smith
GEOG 5300 Geographic Information Systems	DA	23	Dr. Kevin Mulligan
GEOG 5301 Remote Sensing of the Environment	DA	25	Dr. Tina Delahunty
GEOG 5302 Advanced Geographic Information Systems	DA	26	Dr. Kevin Mulligan
GEOG 5309 Seminar in Regional Analysis	DD	27	Dr. Perry Carter
GEOL 5341 Digital Imagery in Geosciences	DA	30	Dr. David Leverington
GEOL 5342 Spatial Data Analysis and Modeling in Geosciences	DA	31	Dr. Seiichi Nagihara
NRM 5310 Advanced Range Ecology	DE	32	Dr. Robert D. Cox
NRM 5322 Advance Nongame Ecology and Management	DE	33	Dr. Clint Boal
NRM 5404 Aerial Terrain Analysis	DA	35	Dr. Ernest Fish
NRM 6303 Imagery Interpretation for NRM	DD	37	Dr. Ernest Fish
NRM 6305 Geospatial Technologies in NRM	DA	39	Dr. Ernest Fish
PSS 5329 Precision Agriculture	DP	40	Dr. Stephen Maas
PSS 5333 Soil and Plant Relationships	DP	41	Dr. Robert Lascano
PSS 5334 Soils and Crops in Arid Lands	DP	43	Dr. Kevin Bronson

**“Theme” Legend**

DA = Natural Resource Data Analysis

DP = Dryland Agriculture

DD = Dryland Economy and Development

DW = Water Resource Management

DE = Ecology and Environmental Studies

## **MAJOR TOPIC: Water Resources and Environmental Technology**

**CE 5366 WATER RESOURCES MANAGEMENT (3 credit hours)**

**REQUIRED COURSE**

**Faculty Information:**

Dr. Ken Rainwater

Office CIV 203D

[ken.rainwater@ttu.edu](mailto:ken.rainwater@ttu.edu)

**Course Information:**

- **Prerequisites:** Consent of Instructor
- **Required Text:** *Principles of Surface Water Quality Modeling and Control*, Thomann and Mueller, and other readings as assigned.

**Course Description and Purpose:**

Models and other technical elements of water resources systems in context of the political, social, and other environments in which they exist.

**Course Outline:**

Week	Text Source	Topics and <b>Events</b>
1	T&M 1	Introduction to Water Quality Modeling
2	2	Rivers and Streams
3		
4	6	Dissolved Oxygen
5		
6	3	Estuaries, Bays, and Harbors
7	4	Lakes, <b>First Review Due</b>
8		<b>Exam 1</b>
9	Readings	Engineering Economy
10		Spring Break
11	Readings	Decision Analysis
12		
13		Surface Water Reservoirs
14		Flood Mitigation, Water Supply
15		Water Resources Development and Policy
16		<b>Second Review Due</b>
17		Review

**Expected Learning Outcomes:**

The student will be trained in the modeling the processes and parameters that determine the fate of man-made discharges on surface water quality. The student will understand the major technical and non-technical considerations required in providing adequate planning and management of water resources projects. The course supports both the environmental and water resources specialty areas.

**Criteria for Grading:**

1. Homework – Several homeworks will be distributed through the semester, usually with one week to complete each assignment. After the graded homeworks are returned the solutions will be posted. Use of spreadsheets is encouraged for repetitive tabular calculations and graphs, but sample calculations are required for full credit. Each student must submit his/her own spreadsheet.
2. Article reviews – Two brief (3-5 pages, typed, double-spaced) reviews of articles from the professional literature will be required during the semester.
3. Exams – Two exams will be given. The final exam will only cover the material after Exam 1. No make-up exams will be given for simple absence. Both exams will be scheduled for 2.5 hr.
4. Class conduct – Students are expected to treat each other and the instructor respectfully. All students are expected to observe appropriate personal hygiene practices.

**Grading Policy**

Homework      30%      Article reviews      20%      Exams      50%      Total: 100%

**Class Attendance:** Required

## **MAJOR TOPIC: Earth Sciences**

### **GEOG 5306 SEMINAR IN GEOGRAPHY OF ARID LANDS (3 credit hours)    REQUIRED COURSE**

#### **Faculty Information:**

Name: Dr. Jeff Lee

Office: Holden Hall 209A

Email: [jeff.lee@ttu.edu](mailto:jeff.lee@ttu.edu)

#### **Course Information:**

- **Prerequisites:** Consent of Instructor
- **Required Text:** There is no required textbook. Readings will be assigned during the semester and students will choose a book to read.

#### **Course Description and Purpose:**

This course deals with the arid and semi-arid regions of the world. We will explore these lands through a combination of relevant topics and regional studies. While the main focus will be on the scientific aspects of the environments, humanistic approaches to the study of arid lands will be part of the course as well. The graduate and undergraduate courses will be taught together and will be organized partly as a lecture course and partly as a seminar.

#### **Course Outline:**

Introduction; Defining Arid Lands

Climate

Landscapes

Plants and Animals

agriculture and water resources.

Exam 1;

North America

South America

North Africa

Southern Africa

Middle East

Central Asia

Australia

Project Presentations

Project Presentations; Conclusions

Exam 2: (Final)

#### **Expected Learning Outcomes:**

After completing this course, the student is expected to 1) Be able to locate the arid and semiarid regions on Earth and in each case explain the climatic reasons for the aridity. 2) Understand the adaptations plants and animals have made to live in arid regions. 3) Explain why the hydrology, soils and geomorphology of arid and semiarid lands are different than in wetter environments. 4) Knowledgeably discuss human adaptation to drylands. 5) Knowledgeably discuss land degradation in arid and semiarid lands.

#### **Criteria for Grading:**

Exam 1 (50 points).

Exam 2 (50 points).

Term Paper (50 points). Topic must be approved. 10 to 15 pages, double spaced.

Book Report (25 points). Book must be approved.

Class Project (25 points).

#### **Class Attendance:**

Attendance is encouraged, but does not directly affect a student's grade.

## **MAJOR TOPIC: Agricultural Science and Natural Resources**

### **NRM 5317 WATERSHED MANAGEMENT (3 credit hours)**

### **REQUIRED COURSE**

#### **Faculty Information:**

Name: Dr. Ernest B. Fish

Office: 102 Goddard Building

Email: [ernest.fish@ttu.edu](mailto:ernest.fish@ttu.edu)

#### **Course Information:**

- **Prerequisites:** Consent of Instructor
- **Required Text:** Brooks, K. N., P. F. Ffolliott, H. M. Gregersen and L. F. DeBano. 2003. Hydrology and the Management of Watersheds. 3<sup>rd</sup> Edition. Iowa State University Press. Ames, Iowa. 574 pp

#### **Course Description and Purpose:**

To provide the student with an understanding of the watershed as a unit of resource oriented planning and development. To provide information on the principles and objectives of watershed planning; physical description of watersheds; relationships between land use conditions and the water delivery character of watersheds.

#### **Course Outline:**

- I. Introduction
  - A. Overview of water resources and watershed planning
  - B. Historical development of watershed planning
  - C. Specialized terminology
- II. Water Resource Problems
  - A. Absolute supply problems
  - B. Regimen or timing problems
  - C. Quality problems
- III. Watershed Planning and Application
  - A. Objectives
  - B. Contents
  - C. Procedures
  - D. Summary
- IV. Hydrologic Processes on Watersheds
  - A. The hydrologic cycle
  - B. Energy balance concept
  - C. Active surface concept
  - D. Precipitation
  - E. Water losses
    1. Interception
    2. Evaporation
    3. Transpiration
  - F. Water movement into and through the soil profile
    1. Infiltration
    2. Percolation
  - G. Runoff
- V. Erosional Processes
  - A. Water
  - B. Wind
- VI. Watershed Protection
  - A. Introduction
  - B. Prevention of damages associated with various resource uses
    1. Road aspects
    2. Forestry aspects
    3. Range and wildlife aspects
    4. Recreational use aspects
    5. General considerations
- VII. Watershed Restoration
  - A. Introduction
  - B. General considerations
  - C. Structural measures
  - D. Vegetative measures
- VIII. Water Yield Manipulation
  - A. Alpine life zone
  - B. Montane life zone
  - C. Phreatophytic manipulation
  - D. Review of specific studies and results

#### **Expected Learning Outcomes:**

1. To provide the student with a knowledge of techniques and sources for watershed planning and application.

2. To provide the student with a background knowledge of water resource problems and the historical development of watershed planning.
3. To provide the student with a knowledge of the hydrologic cycle components and understanding of their functional relationships.
4. To provide the student with a basic knowledge of erosional processes.
5. To provide the student with a knowledge of watershed protection principles and techniques involving various types of natural resource management.
6. To provide the student with a basic knowledge of watershed restoration practices.
7. To provide the student with a basic knowledge of the results of water yield control efforts resulting primarily from vegetative manipulation on the watershed.
8. To provide the student with a sufficient background to enable him or her to make sound land planning recommendations, based on the objectives of watershed planning and other resources.

**Criteria for Grading:**

Graded material will consist of two hourly exams and a final exam, all of which carry equal weight and are comprehensive in nature. Additionally, unannounced quizzes, various problem sets and projects may be assigned throughout the semester. Total point accumulation for the entire course is normally 450-550.

Letter grades for the course are based upon the following percentage categories applied to the total available number of points during a semester.

<b>A</b>	<b>90-100</b>
<b>B</b>	<b>80 - 90</b>
<b>C</b>	<b>70 - 80</b>
<b>D</b>	<b>60 - 70</b>
<b>F</b>	<b>&lt;60</b>

Student must pass the final exam to receive a passing grade for the course.

**Class Attendance:**

100 points is allocated to class participation. Five points are deducted for each unexcused absence.

## **AAEC 5314 Environmental Economics and Policy Analysis**

### **Faculty Information:**

Dr. Jeff Johnson      Agricultural Sciences      [jeff.johnson@ttu.edu](mailto:jeff.johnson@ttu.edu)

### **Course Description:**

In this course we will distinguish between natural resource issues and environmental issues. Natural resource management deals with resources such as water, oil and gas, forests, wildlife, and agriculture. The issues faced by natural resource managers are generally supply and distribution of those resources in a sustainable manner. Environmental issues include pollution of resources such as water, air, or land and focus on policies and economic tools that will reduce, mitigate, or prevent pollution.

### **Learning Outcomes:**

This course has one general learning outcome. Upon completion of this course, you will be able to understand and use basic economic concepts to evaluate natural resource and environmental issues. Additionally, each section has lesson objectives that support those of the overall course.

### **Course Outline:**

#### **a. Section 1. Economic Concepts**

**Learning Outcomes:** Upon completion of this section of the course, the student will be able to understand the following economic concepts in preparation for using the concepts to analyze policies:

- Understand how economics is used to value the environment.
- Understand concepts of net benefits, net present value, and static and dynamic efficiencies
- Understand risk assessment, valuation methods, and discount rate issues
- Understand property rights and externalities
- Understand intertemporal fairness and economic sustainability

#### **b. Section 2. Natural Resource Economics**

**Learning Outcomes:** Upon completion of this section of the course, the student will be able to:

- Understand the concepts of efficient intertemporal and market allocations.
- Identify and discuss major issues pertaining to management of energy, water, agriculture, forest, and commercially valuable species.
- Analyze selected policies of one of the above natural resources using the economic methods discussed.

#### **c. Section 3. Environmental Economics**

**Learning Outcomes:** Upon completion of this section of the course, the student will be able to:

- Understand efficient and market allocation of pollution and efficient and cost-effective policy responses to pollution.
- Identify and discuss major environmental issues of local air pollution, regional and global pollutants, transportation, water pollution, solid waste, and toxic waste.
- Analyze selected policies of one of the above environmental issues the economic methods discussed.

### **Methodology:**

You will meet the course learning objectives through individual study of the required readings, review and analysis of pertinent issues, research and review of additional readings, and the completion of course written requirements. You may discuss the subject matter with others who might contribute to your learning.

- a.** The lesson order takes you from understanding of economic concepts, to natural resource management issues, environmental issues such as pollution mitigation and prevention, and finally to issues of sustainability.
- b.** In each section, you will develop the concepts and issues through a series of readings from the textbook and from articles from other sources. In sections 2 and 3, we will analyze the economics of various issues through specified readings, then you will provide an economic analysis of one issue of your choosing and approved by the instructor.
- c.** A writing requirement will be designated for each section. The requirement for sections 2 and 3 will pertain to your selected issue.
- d.** The final exam will be a paper dealing with a sustainability issue that will require you to use concepts developed throughout the course.
- e.** Your comprehension and knowledge of the material in each lesson is evaluated. In general you should be able to answer the requirement satisfactorily from the material within the lesson. In all of the requirements, I am interested in how you use the concepts to develop the solution to the proposed problems. I am interested in your thoughts and how you express them; however, you should have some basis for your thoughts. Your solution to the writing requirement should answer the questions in a manner that shows your comprehension of the course material.

### **Course Materials:**

The resources listed below will be used throughout the course and contain assigned readings and references required to achieve the learning objectives and complete the course requirements.

Tietenberg, T. Environmental Economics and Policy. Fifth Edition. Pearson Addison

Wesley Publishing. 2006. ISBN-13: 9780321348906

Ellsworth, B. and J.A. Higgins. English Simplified. Tenth Edition. Longman Publishers. 2004.

TTU Guidelines for Dissertations and Theses. Chapter 2.

<http://www.depts.ttu.edu/gradschool/current/THDGuidelines.php>

**Written Requirements:**

All grades for this course will be earned through written assignments. Ellsworth and Higgins publication is a quick refresher and good reference for grammar and punctuation usage. Use the TTU guidelines for proper format of the assignments.

## **AGSC 5303 ECOLOGY OF GRAZING LANDS SYSTEMS (3 credit hours)**

### **Faculty Information:**

Dr. Vivien G. Allen	Dept. of Plant and Soil Science, Texas Tech	<a href="mailto:Felician@ttu.edu">Felician@ttu.edu</a>
Dr. John Fike	Dept. Crop and Soil Env. Sci., Virginia Tech Blacksburg	<a href="mailto:jfike@vt.edu">jfike@vt.edu</a>
Dr. Rob Kallenbach	Div. Plant Sciences, U. Missouri Columbia	<a href="mailto:KallenbachR@missouri.edu">KallenbachR@missouri.edu</a>
Dr. Paul Olenbusch	Pasture and Range Mgmt., Kansas State U. (Retired)	
<a href="mailto:ole7734@suddenlink.net">ole7734@suddenlink.net</a>		
Dr. John Waller	Dept. Animal Science, U. Tennessee	<a href="mailto:jwaller@utk.edu">jwaller@utk.edu</a>

### **Course Information:**

- **Prerequisites:** Verification of qualification by the student's major professor and permission of the instructor is required. Because students will come from a number of different institutions with differences in curricula, prerequisites must be in subject matter and not in specific courses. It is recommended that students should have completed at least one course at the junior or higher level in each of five of the following subject matter groups prior to taking this class,  
Group One: Forage Crop Ecology, Forage Management, Range Management, Range Improvement  
Group Two: Ruminant, Nutrition, Feeds and Feeding, Equine Nutrition, Beef Cattle Nutrition, Dairy Cattle Nutrition, Beef Cattle Management, Sheep Management Dairy, Cattle Management, Ruminology  
Group Three: Soil Fertility and Fertilizers  
Soil Chemistry Soil  
Management Soil Physics  
Soil Genesis and Morphology  
Group Four: Biochemistry, Physiology (Plant or Animal), Toxicology  
Group Five: Statistics, Biometry  
Group Six - A course in group six can be substituted for meeting a requirement in groups 1 through 5 Ecology Economics Farm Management Plant Taxonomy Agrostology Wildlife Management
- **Required Text:** No required text
- Other required supplies or financial obligations: A \$600 (US) field-trip fee is charged for each student. This fee covers transportation costs during the field trip, lodging, and meals. Students are responsible for transportation to the departure point for the trip and for their return from the ending point of the trip.

### **Course Description and Purpose:**

A field oriented course that takes participants into diverse grazing lands ecosystems across several states and may include other countries. Students learn about (a) the components and functions of grazing lands and how these vary in different ecoregions, (b) research needs, objectives and techniques in soil-plant-animal research, (c) forage-livestock ecology and systems in grazing lands (cropland, pastureland, rangeland and forestland), (d) the role of forages in conservation practices, wildlife habitat, and sustainable agriculture, and (e) industries involved with forages and livestock.

This is a graduate level course that includes a two-week field trip and is open to students who meet the qualifications. Graduate credit is received through your home institution and is credited to your program of study. Enrollment is limited to about 24 students and is taught during the first summer semester (quarter). Routes for the field trip will be different each time the course is offered, and students will travel through widely divergent ecosystems. International trips offered in some years.

Forages play a key role in addressing the issues of sustainability of agriculture and the environment. Forages are grown on more than half of the land in the United States. Private grazing lands occupy more than one-third of the land area in the lower 48 states. Forages and grazing lands are central to soil conservation, clean water, wildlife habitat, recreation, and open space, and they provide the major portion of the diets of domesticated ruminants and equines. As we seek solutions to the complex issues of maintaining agricultural production while preserving and protecting the environment and our future productive potential, we find that forages are central to these issues. It is critical that we provide learning opportunities for students that allow them to comprehend broad principles that extend across ecoregions. Students must take an integrated, systems approach to solving problems of agriculture and the environment. This can best be taught by bringing together an array of expertise and providing exposure to a broad range of sites.

While multidisciplinary courses such as this are needed, few universities have the required number of graduate students and the attendant resources to offer them. The multiuniversity nature of this course allows students and faculty from any cooperating university to participate. Benefits of this process include the interaction and sharing of knowledge among students and professors from a



number of institutions and areas of expertise. Because faculty and students are from various universities, students become more knowledgeable about programs in other areas.

**Course Outline:**

No textbook is required. A core set of reading assignments provides the necessary background information. Selected reading assignments from publications and technical papers will familiarize students with the sites to be visited as well as with the professionals they will meet. Prior to departing on this trip, four modules are to be completed by students. This will be conducted using an online 'Knowledge Hunt' where students are directed to locate and synthesize specific information relevant to understanding information during the trip and better equipping them to ask relevant questions. This is to be completed between March 1 and May 1.

During the class, a Daily Journal must be kept by each student. At the end of the trip, the student should be able to articulate: (a) What this experience has meant to them. (b) How they can apply information gained to their future careers (teaching, research, production, etc). (c) How this experience relates to their graduate program. (d) How this course has changed their ideas of what they might do in the future.

(e) How it changed their perspective of grasslands and their function within ecosystems and ecotomes across ecoregions. (f) What impact the course has had on them.

**Expected Learning Outcomes:**

- 1). To gain first-hand experiences in grazing land ecology through various ecoregions and to learn about techniques to address education and researchable needs. Students will become familiar with research needs and objectives in several geographical and climatic areas, techniques used in soil-plant-animal research, forage-livestock ecology, systems that include native and/or introduced forage species, and intensive and extensive management. Students will be able to qualify and quantify differences in ecosystems and the resultant effects on forage-livestock systems and agriculture in general. By familiarizing students with different ecosystems, they will be better able to integrate grazing management, watershed management, wildlife issues, and conservation of natural resources.
- 2). To gain interactions with professionals active in the multidisciplinary areas of forage livestock research, teaching, extension, industry, and production. As a result, students will gain a greater appreciation and knowledge of the interdisciplinary nature of forage-livestock research. The importance of forage-livestock systems as an integral component of agriculture and how they contribute to productive, economically viable, socially acceptable, and sustainable agricultural systems will become evident to students.

**Criteria for Grading:**

Grading is based on completion of pre-trip modules and upon participation in class activities during the two-week trip. An oral exam is given at the conclusion of the trip in a group setting.

**Class Attendance:**

Policy: Mandatory. Non-attendance constitutes withdrawal from this class.

## **ATMO 5302 WEATHER, CLIMATE AND APPLICATIONS (3 credit hours)**

### **Faculty Information:**

Colleen A. Leary

Office - BA 1207

[colleen.leary@ttu.edu](mailto:colleen.leary@ttu.edu)

### **Course Information:**

- **Prerequisites:** None
- **Required Text:** Meteorology, Understanding the Atmosphere, by Ackerman and Knox (1st Edition). Please bring your textbook to class.

### **Course Description and Purpose:**

Teaches basic principles of atmospheric science, with particular emphasis on applications, including severe weather, air pollution, and global climate change. The Atmospheric Science Group in the Department of Geosciences offers this graduate course to contribute to the Multi-Disciplinary Science M.S. degree program for elementary through secondary science teachers. The course's intrinsic value lies in its use of basic physical principles to explain interesting and important phenomena in our atmospheric environment. Understanding phenomena like clouds, precipitation, and winds add interest and meaning to watching the sky. Understanding phenomena like hurricanes, flash floods, lightning, severe thunderstorms, and tornadoes increases appreciation of the strength and intensity of natural forces. Learning the facts about prolonged exposure to ultraviolet radiation, air pollution, extreme heat and cold, extreme wind and cold, and extremes in pressure makes it less likely that we and those in our care will suffer their ill effects. Our ability to contribute to discussions and decisions about public policy will increase along with our knowledge of air pollution, climate, global warming, ozone holes, and El Niño.

### **Course Outline:**

#### Class Date Subjects and Textbook Chapter and Page References

1. 29 Aug. Weather elements; composition of the atmosphere; air pollution; ozone; ozone holes; radiation; energy balance; greenhouse effect; temperature; stability  
Chapter 1: Pages 1-18  
Chapter 2: Pages 27-31, 32-33, 36-44, 47-52  
Chapter 3: Pages 57-59, 65, 68-70, 74-76 Box 3.1  
Chapter 4: Pages 110-112  
Chapter 10: Pages 301-304  
Chapter 15: Pages 433-438, 440-441
2. 12 Sept. Seasons and temperature; winds and advection; climate typing with respect to temperature; growing, heating, and cooling degree days, wind chill, heat index; humidity  
Chapter 2: Pages 44-47, 50-53  
Chapter 3: Pages 59-65, 70-81  
Chapter 4: Pages 86-94  
Chapter 14: Pages 401-403
3. 19 Sept. Fog and clouds; how clouds produce rain; climate typing with respect to precipitation; dew and frost; weather modification; frozen precipitation; icing; visibility  
Chapter 4: Pages 92-123  
Chapter 2: Pages 32-36, 50-53  
Chapter 12: Pages 355-356  
Chapter 14: Pages 401-403
4. 26 Sept. Remote sensing; radar, satellites  
Chapter 5: Pages 132-148
5. 3 Oct. Catch up or move ahead day. Class ends at 7:30 p.m. on this night only
6. 10 Oct. Measuring pressure; winds and forces; thermal circulations; sea breeze, mountain winds, and monsoons; general circulation of the atmosphere and oceans  
Chapter 1: Page 20  
Chapter 5: Pages 130-132  
Chapter 6: Pages 159-186  
Chapter 7: Pages 190-206  
Chapter 12: Pages 351-352; 353-354
7. 17 Oct. El Niño  
Chapter 8: Pages 209-222  
Chapter 2: Pages 66-69
8. 24 Oct. Hurricanes  
Chapter 8: Pages 223-245
9. 31 Oct. Air masses, fronts, and extra-tropical cyclones  
Chapter 1: Pages 18-24  
Chapter 2: Pages 31-32

- Chapter 5: Pages 128-132  
 Chapter 9: Pages 249-268  
 Chapter 10: Pages 271-304  
 Chapter 12: Pages 342-343; 350-351; 352-353 Box 12.4
10. 7 Nov. Weather forecasting; stability and convection; air parcels  
 Chapter 13: Pages 363-397  
 Chapter 1: Pages 21-24  
 Chapter 2: Pages 32-36  
 Chapter 3: Pages 74-79  
 Chapter 12: Pages 339-342, 354-355
  11. 14 Nov. Thunderstorms and tornadoes; lightning; the dry line; microbursts  
 Chapter 11: Pages. 307-335  
 Chapter 12: Pages. 344-350
  12. 21 Nov. Climate types  
 Chapter 14: Pages. 401-411
  13. 28 Dec. Climate change  
 Chapter 14: Pages 411-428
  14. 5 Dec. Global warming  
 Chapter 15: Pages 431-454

**Expected Learning Outcomes:**

After completing this course you will be able to:

- Calculate heating, cooling and growing degree-days, utilize wind chill and heat index charts, and explain the health effects of extremely high and low temperatures, air pollution, and exposure to ultraviolet radiation.
- Interpret the appearance of the sky by identifying the major cloud groups and their locations within large and small weather systems.
- Explain the possibility of global warming and the roles land-surface changes, air pollution, greenhouse gases, clouds, and the oceans in climate change.
- Analyze force-balance concepts and relate them to horizontal wind patterns that explain vertical air motions and weather in high and low pressure systems.
- Differentiate between hurricanes (tropical cyclones) and extra-tropical cyclones in terms of their origins, life cycles, temperature distributions, precipitation patterns, and wind patterns.
- Combine basic information about the atmosphere and the ocean to construct a conceptual model of the El-Niño-Southern Oscillation.
- Characterize the different stages of the life cycles of thunderstorms and tornadoes and point out likely areas for the occurrence of various types of severe thunderstorm weather.
- Critique weather forecasting methods, including numerical weather forecasts.
- Group different geographical areas by type of climate and explain the factors that determine climate type.

**Criteria for Grading:**

The expected learning outcomes for this course will be assessed by:

- In-class graded quizzes, In-class application activities, Polling the class, Class discussions, Active learning activities

**Class Attendance:**

Attendance at every class is an important part of this course.

## **BIOL 5330 ADVANCED LANDSCAPE ECOLOGY (3 credit hours)**

### **Faculty Information:**

Name: Dr. Nancy E. McIntyre    Office: Room 420 Biology Building    [nancy.mcintyre@ttu.edu](mailto:nancy.mcintyre@ttu.edu)

### **Course Information:**

- **Prerequisites:** Instructor consent
- **Required Text:** Gergel, S.E., and M.G. Turner, eds. 2002. *Learning Landscape Ecology: A Practical Guide to Concepts and Techniques*. Springer, New York.
- Other required supplies or financial obligations: 1GB (minimum size) flash drive

### **Course Description and Purpose:**

Landscape ecology is the study of the effect of spatial patterns on ecological processes and how those processes in turn create environmental patterns. This field represents a new awareness among ecologists that spatial patterning can no longer be ignored nor environments assumed to be homogeneous for logistical convenience; rather, spatial patterning is now recognized to be a dynamic force in ecology and not just a statistical nuisance. Fundamental principles of landscape ecology serve as foundations for decision-making and problem-solving in conservation biology, natural resource management, and urban planning and development.

### **Course Outline:** Weekly course outline found at

<http://www.biol.ttu.edu/faculty/nmcintyre/Landscape%20Ecology/topics.htm>

### **Expected Learning Outcomes:**

Upon successful completion of course requirements, students will be able to quantify spatial heterogeneity and its effects on biological processes affecting individuals, populations, and communities (including dispersal, risk of extinction, and diversity), and to discuss why such skills are necessary to conservation and natural resource management (e.g. in terms of reserve design and placement). There will be a weekly computer lab session, where students will conduct hands-on exercises; after successfully completing this class, students will be able to perform the most common methods of data analysis used in landscape ecology, including Markov and neutral landscape modeling and spatial statistics such as semivariance and autocorrelation analyses, using software packages that are standards in the field, including Fragstats and Rule.

### **Methods for Assessing Learning Outcomes:**

- (1) student performance on lecture exams
- (2) student performance on weekly lab exercises
- (3) student performance on cumulative lab exam
- (4) change in performance on a pre/post diagnostic test
- (5) student performance on cumulative lecture final exam
- (6) participation in discussion section held outside normal course hours

### **Criteria for Grading:**

- 10% on exam I
- 10% on exam II
- 10% on exam III
- 30% on cumulative final lecture exam
- 40% on lab

### **Requirements for Graduate Students:**

Grad students will be expected to exhibit a more thorough and synthetic mastery of the subject; consequently, they will have different tests from undergrads. Grad students will also be involved in a regular discussion section, during which papers from the recent and classic landscape ecology primary literature will be examined and critiqued.

### **Absences and Missed Assignments:**

Because there is a causal relationship between attendance and performance, I do take note of attendance. Make-up assignments will be given only in the event of a satisfactory, written excuse (e.g. doctor's note or TTU-sanctioned absence). Students with unexcused absences should not even *think* of enquiring about how to improve their grade, extra credit, or the like.

## **CE 5361 SURFACE WATER HYDROLOGY (3 credit hours).**

### **Faculty Information:**

Dr. Ted Cleveland

Dept. of Civil Engineering

### **Course Description and Purpose:**

Advanced study of hydrologic cycle: hydrologic abstractions, surface-runoff mechanics, hydrographs, baseflow separation, data analysis, reservoir and channel routing, and an introduction to rainfall-runoff modeling.

### **Expected Learning Outcomes:**

The purpose of this class is to study hydrologic processes in the context of analysis and design and to apply selected hydrologic models to the analysis of real watersheds.

The student will be able to

1. Delineate watersheds by their topographic and anthropogenic features<sup>1</sup>, and estimate various physical metrics of a watershed (length, slopes, etc.).
2. Analyze, synthesize, and apply runoff hydrographs for engineering design.
3. Analyze, synthesize, and apply abstractions (storage and losses) for engineering design.
4. Route hydrographs using a variety of hydrologic technologies.
5. Read, synthesize, and communicate ideas presented in current and historical technical literature.

### **ABET Program Outcomes Addressed in CE 53612:**

- 3[a]. Ability to apply knowledge of mathematics, science, and engineering.
- 3[b]. Ability to design and conduct experiments, as well as to analyze and interpret data.
- 3[e]. Ability to identify, formulate, and solve engineering problems.
- 3[i]. Recognition of need for life-long learning.
- 3[k]. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- 8[d]. Proficiency in water resources engineering.

### **Course Schedule:** by week

- 1 Hydrologic cycle. Mass, momentum, and energy. Conduit, open, and porous flow.
- 2 Atmospheric, and sub-surface water.
- 4 Surface water, measurements and data sources.
- 6 Unit Hydrographs. Convolution/deconvolution and synthesis.
- 8 Hydrologic and hydraulic routing
- 9 Mid-term Exam: All covered
- 10 Probability estimation, and frequency analysis.
- 12 Design storms and event modeling.
- 14 Continuous-simulation modeling
- Final Exam: All covered

### **Prerequisites:**

Mastery of material from CE 3354 or an equivalent physical hydrology course is required.

### **Attendance:**

If you come to class every day, you won't miss anything. Please let the instructor know if you must miss a class for a legitimate reason.

### **Grading:**

Final grades are determined based on performance during the semester. Letter grades will be assigned using University standards. The approximate weighting of graded material in determining the final grade is as follows:

- Article Reviews 10%
- Homework 40%
- Examinations 50%

## **CE 5363 GROUNDWATER HYDROLOGY (3 credit hours)**

### **Faculty Information:**

Dr. Ken Rainwater

Office CIV 203D

[ken.rainwater@ttu.edu](mailto:ken.rainwater@ttu.edu)

### **Course Information:**

- **Prerequisite:** CE 3354 or consent of instructor.
- **Textbook:** Fetter, C.W., 2001, Applied Hydrogeology, 4th ed., Prentice Hall, Englewood Cliffs, New Jersey.

### **Other Required Materials:**

McDonald, M.G. and Harbaugh, A.W., 1988, A Modular Three-Dimensional Finite-Difference Groundwater Flow Model, Chapter A1, Book 5, Techniques of Water-Resources Investigations of the United States Geological Survey, USGS, Reston, Virginia. Also other MODFLOW support files.

### **Course Purpose:**

The purpose of this course is to introduce the student to the hydrogeologic, hydrologic, and engineering principles that are applied to problems of groundwater investigation, development, production, and quality.

### **Course Objectives:**

Upon successful completion of this course, the student will be able to do the following.

1. Determine hydrogeologic parameters from geologic materials, field tests, and estimates.
2. Describe subsurface conditions with proper hydrogeologic terminology.
3. Apply analytical and numerical modeling techniques to simulate groundwater flow in ideal and nonideal aquifer systems.
4. Recognize the importance of groundwater quality in consideration of regional flow descriptions and water resource development.

### **Topics:**

1. Connections between geological and geotechnical information to hydrogeologic and hydraulic parameters.
2. Description, measurement, and/or estimation of aquifer hydraulic parameters.
3. Construction of hydraulic head contours for homogeneous, isotropic conditions.
4. Application of Darcy's Law for horizontal and vertical flow.
5. Application of appropriate analytical relationships for radial flow to wells.
6. Performance and analyses of pump tests for aquifer parameters.
7. Performance and analyses of slug tests for aquifer parameters.
8. Application of superposition to represent aquifer boundaries and well interference.
9. Application of MODFLOW for numerical simulation of non-ideal aquifer systems.
10. Well drilling, development, construction, and rehabilitation procedures.
11. Regional groundwater flow patterns, recharge and discharge areas.
12. Unsaturated zone conditions.
13. Equilibrium water chemistry, especially carbonate equilibrium.
14. Groundwater contamination concerns.
15. Development and management of well fields.
16. Groundwater rights.

### **Class Schedule:**

Class meets fifteen weeks, three times per week for 50 minutes per class session.

### **Evaluation Process:**

1. Homework – There will be six to eight homework assignments scattered through the course, usually with two class days (or one week) between assignment and due date allowed for completion. There is no late policy. Solutions should include brief problem statements and outline the solution approach leading to a well-labeled answer. Work on one side of the paper only. Illegible homework will be returned ungraded. Computer applications will be used on some assignments. Students are expected to be computer literate. When spreadsheets are used, sample calculations are required, and each student must turn in his/her own result.
2. Project – There will be one individual modeling project during the middle of the semester. The groundwater model will be available for PC use.
3. Exams – Two exams, one at midterm and one during the final period, will be given. No make-up exams will be given for simple absence. If a student has an emergency conflict with any assignment, prior notice must be given to the instructor.
4. Class Conduct – Students are expected to treat each other and the instructor respectfully. All students are expected to observe appropriate personal hygiene practices.
5. Grading Policy

CE 5363

Homework

20%

Two Exams	40%	
Project		20%
Two Reviews		20%
	100%	

**Contribution of Course to Professional Component of the Curriculum:**

This course is one of the two groundwater courses in the MENVE curriculum. This course builds on the water resources background begun in CE 3354 Engineering Hydrology by emphasizing hydraulics of groundwater flow in simple to complex situations. This course prepares students to deal with investigation and development of groundwater resources, an important part of the nation's water supply. The following graduate course, CE 5364 Groundwater Transport Phenomena, emphasizes the movement of dissolved and liquid phase contaminants in the subsurface. These two courses complete the preparation of the students for most practical problems in groundwater quantity and quality. Individual projects are used in both courses to simulate the working environment in engineering practice.

**Relationship to Program Objectives:**

This course provides the conceptual framework, mathematical tools, and modern software techniques to insure the students' proficiency in engineering problems associated with use of groundwater resources. As water supply and quality issues are integral for civil and environmental engineers, this material addresses the objectives of both the civil engineering and environmental engineering degree programs.

**ABET Program Outcomes:**

- 3(a) an ability to apply knowledge of mathematics, science, and engineering
- 3(c) an ability to design a system, component, or process to meet desired needs
- 3(e) an ability to identify, formulate, and solve engineering problems
- 3(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- 8(e) proficiency in water resources engineering
- 8(g) design a system, component, or process in more than one civil engineering context

## CE 5364 GROUNDWATER TRANSPORT PHENOMENA (3 credit hours)

### Faculty Information:

Dr. Ken Rainwater

Office CIV 203D

[ken.rainwater@ttu.edu](mailto:ken.rainwater@ttu.edu)

### Course Information:

- **Prerequisites:** Consent of Instructor
- **Required Text:** *Ground Water Contamination*, 2<sup>nd</sup> ed., Bedient, Rifai, and Newell. Some computer manuals will be required at different times during the semester.

### Course Description and Purpose:

Study of sources and fates of contamination in groundwater. Mathematical modeling of reactive and nonreactive pollutant movement. Aquifer restoration strategies.

### Course Outline:

Week	Topics and <b>Events</b>
1	Introduction (Ch 1), Contamination Sources (Ch 4)
2	Anisotropy, Transport Mechanisms (Ch 6)
3	Fate Processes (Ch 7), Modeling Attenuation (Ch 8)
4	Risk Assessment
5	Risk Assessment
6	Numerical Models (Ch 10), Attenuation and RBCA (Ch 12)
7	MODFLOW/MODPATH/MOC3D Model, <b>First Review Due</b>
8	<b>Exam 1</b>
9	Site Investigations (Ch 5)
10	Spring Break
11	Flow and Transport in Unsaturated Zone (Ch 9)
12	CHEMFLO Model
13	NAPLs (Ch 11)
14	Remediation Alternatives (Ch 13)
15	Legal Protection (Ch 14), <b>Second Review Due</b>
16	
17	Review

### Expected Learning Outcomes:

The student will be trained in the fundamental descriptions of the physical and chemical processes that control the movement of contaminants in the subsurface. Analytical solutions and existing computer models will be presented to typify the available tools with corresponding limitations.

### Criteria for Grading:

1. Homework and projects – Several homework and project assignments will be distributed through the semester, weighted according to their relative scopes. After the graded homeworks are returned, the solutions will be posted. Use of spreadsheets is encouraged for repetitive tabular calculations and graphs, but sample calculations are required for full credit. Each student must submit his/her own spreadsheet.
2. Article reviews – Two brief (3-5 pages, typed, double-spaced) reviews of articles from the professional literature will be required during the semester.
3. Exams – Two exams will be given. The final exam will only cover the material after Exam one. No make-up exams will be given for simple absence.
4. Class conduct – Students are expected to treat each other and the instructor respectfully. All students are expected to observe appropriate personal hygiene practices.

### Grading Policy

Homework and projects: 40%    Article reviews: 20%    Exams: 40%    Total: 100%

### Class Attendance:

Required



## **CE 5394 NATURAL SYSTEMS FOR WASTEWATER TREATMENT (3 credit hrs.)**

### **Faculty Information:**

Dr. C. B. Fedler, Rm. 202 Civil Engineering Building

### **Required Texts:**

- Natural Systems for Waste Management and Treatment, by S.C. Reed, R.W. Crites and E.J. Middlebrooks. Second Edition, ISBN 0-07-060982-9.
- EPA, 1981, Process Design Manual: Land Application of Municipal Wastewater (EPA-625/1-81-013)

### **Course Objective:**

The objective of this class is for a student to learn how to design various types of natural wastewater treatment systems for treating various types of wastewater streams.

### **Course Outline:**

#### **Introduction**

Examination of municipal wastewater  
General concepts of land application of wastewater  
Fate of wastewater constituents

#### **Slow Rate Systems**

Design considerations  
Crop selection, buffer area, drainage, retention ponds, crop harvesting, storm water, irrigation systems  
Preapplication treatment  
Water application efficiency - sprinklers  
Land limiting constituents  
Nitrogen removal and nitrogen balance  
Land requirements  
Determination of storage requirements  
Fixed irrigation schedule, variable leaching (TWC method)  
Fixed leaching, variable irrigation  
Operation and maintenance  
Monitoring/Management

#### **Rapid Infiltration Systems**

Basic concepts of the system  
Nutrient removal processes  
Design considerations  
hydraulic loading rate, infiltration rate, mound dissipation  
Operation and maintenance  
Monitoring/Management

#### **Overland Flow Systems**

Basic concepts of the system  
Nutrient removal processes  
Design considerations  
Crop selection, hydraulic loading, slope, infiltration rate  
Start-up problems, temperature effects  
Operation and maintenance  
Monitoring/Management

#### **Pond Systems**

Aerobic  
Anaerobic  
Others

#### **Wetland/Aquacultural Systems**

Components  
plants, soil, organisms, etc.  
Pond design  
Performance  
Design considerations  
Operation and maintenance

#### **Land Application of Hazardous Wastes (if time permits)**

Basic concepts of the system  
Review of hazardous waste regulations  
Review of reported treatment systems  
Process required to obtain a permit  
Design philosophy

**Learning Outcomes:**

After completing this course, students will be able to:

- 1) Calculate the mean crop consumptive use for various plants and free surface water bodies
- 2) Analyze the land limiting constituents for a surface application system for wastewater
- 3) Complete a water balance, nutrient balance, and a salt balance for a surface application system
- 4) Determine the storage requirements for a natural wastewater treatment system
- 5) Design a slow rate land application system
- 6) Design a overland flow land application system
- 7) Design a rapid infiltration land application system
- 8) Design the various types of pond systems for treating wastewater
- 9) Design a surface flow wetland
- 10) Design a subsurface flow wetland

**Outcome Assessment:****GRADING SCALE - PERCENTAGE OF GRADE**

Problem Sets - 25%

Semester Project - 25%

Midterm Exam - 25%

Final exam - 25%

**NOTE:** All assignments, computer programs and the design project must be turned in to obtain a passing grade in the course. Late work will be deducted by half the graded score unless prior arrangements have been made.

## **ENTX 6361 ENVIRONMENTAL AND WILDLIFE TOXICOLOGY (3 credit hours).**

### **Faculty Information:**

Dr. Phil Smith Institute of Environmental and Human Health

### **Course Information:**

- **Prerequisite:** Organic chemistry, ecology, or consent of instructor.

### **Course Description and Purpose:**

This course will address impacts of toxic substances on the fitness, survival, and reproduction of wildlife species. The procedures used to investigate these impacts will be presented.

Environmental contaminants that will be discussed include pesticides, metals, petroleum products, persistent organic pollutants, and endocrine disrupting chemicals. The course will be taught from the perspective of an ecological risk assessor. This course will be valuable to future wildlife and environmental science professionals.

### **Course Outline:**

January	Historical perspective of wildlife and environmental toxicology Laws and regulations pertaining to wildlife and environmental toxicology Principles of toxicology
February	Uptake, biotransformation, and elimination of toxic substances Ecological aspects of toxicology Integrating toxicology and ecology Exposure to contaminants among wildlife Biochemical and physiological measures of toxicity Quiz 1 Terrestrial Ecotoxicology
March	Aquatic toxicology Pesticides and wildlife Pesticides and wildlife Spring Break Spring Break Metals and wildlife Metals and wildlife
April	Persistent organic pollutants and wildlife Persistent organic pollutants and wildlife Petroleum products and wildlife Quiz 2 Endocrine disrupting compounds and wildlife Endocrine disrupting compounds and wildlife Emerging contaminant threats to wildlife Indirect and sublethal effects of contaminants in wildlife Ecological risk assessment
May	Final Exam

**Grading Policy:** Grades will be based on point totals accumulated on 2 quizzes, and a comprehensive final exam.

Quizzes =  $100 \times 2 = 200$  points

Final exam = 150 points

Final letter grades will be assigned based on the following scale:

A = 315 – 350 points

B = 280 – 314 points

C = 245 – 279 points

D = 210 – 244 points

F = 0 – 209 points

The instructor reserves the right to curve grades upwards. Extra credit is possible, but will only be granted following additional effort by the student requesting the credit. Extra credit (up to 25 points) assignments may include, but are not limited to writing reviews of wildlife toxicology topics, or wildlife-based risk assessments.

### **Expected Learning Outcomes and Assessment:**

Upon completion of this course the student should have a generalized knowledge of wildlife toxicology principles, a wide variety of environmental contaminants affecting wildlife populations, methods used to evaluate the exposure and effects of toxicants in wildlife, and the EPA risk assessment process. They should be capable of evaluating exposure and effects information as it relates to wildlife, and understand how these concepts are considered together to determine risk. In addition to the testing schedule detailed above, student learning of these concepts described above will be monitored by in-class discussions that will include frequent queries from the instructor.

**Attendance:** Expected, and highly recommended.

## **ENTX 6371 PROCEDURES AND TECHNIQUES IN ECOLOGICAL RISK (3 credit hours)**

### **Faculty Information:**

Dr. Philip N. Smith      Institute of Environmental and Human Health      [phil.smith@ttu.edu](mailto:phil.smith@ttu.edu)

### **Course Information:**

- **Prerequisites:** None
- **Required Text:** 1. US EPA Risk Assessment Guidelines  
2. Ecological Risk Assessment for Contaminated Sites. Suter et al., eds., Lewis Publishers, Boca Raton, FL

### **Course Description and Purpose:**

To provide students with a solid foundation in risk assessment methods. Specifically, students will learn how the ecological risk assessment framework developed by the U.S. Environmental Protection Agency is used to assess the potential hazards of chemicals in the environment with specific focus placed on hazardous waste sites (Superfund). □

### **Course Outline:**

August	Syllabus
September	Course Outline, Goals, Strategies for Success What is risk, Risk Perceptions, Policy of Risk Assessment Risk Assessment Frameworks Problem Formulation, Assessment Endpoints Conceptual Models and Analysis Plans Quiz 1 Analysis of Exposure Analysis of Exposure Analysis of Effects
October	Analysis of Effects Risk Characterization NO CLASS NO CLASS Risk Characterization Quiz 2 Uncertainty Analysis Probabilistic Methods Risk Communication and Management
November	EPA FIFRA Risk Assessment Process AQUATIC EPA FIFRA Risk Assessment Process TERRESTRIAL Emphasizing Ecology in Ecological Risk Assessment Quiz 3 Case Studies NO CLASS SETAC National Meeting Case Studies NO CLASS Thanksgiving
December	Case Studies Review COMPREHENSIVE FINAL EXAM

### **Expected Learning Outcomes:**

Upon completion of this course the student should have a generalized knowledge of the EPA risk assessment framework, and how it is applied to risk assessments on hazardous waste sites. They should be capable of evaluating risk in terms of exposure and effects, and understand how these concepts are considered together to determine risk. Students should have a basic understanding of methods of integrating exposure and effects risks via several methods including the quotient method and probabilistic risk assessments. Students will learn how ERA relates to natural resource damage assessments. Students will also have a basic understanding of how ecological risk assessments are applied to situations other than hazardous waste site evaluations (e.g. pesticide registration). In addition to the testing schedule detailed above, student learning of these concepts described above will be monitored by in-class discussions that will include frequent queries from the instructor.

### **Criteria for Grading:**

Grades will be based on point totals accumulated on 3 quizzes, and a comprehensive final exam.

Quizzes =  $100 \times 3 = 300$  points

Final exam = 150 points

Final letter grades will be assigned based on the following scale:

A = 405 – 450 points

B = 360 – 404 points

C = 315 – 359 points

D = 270 – 314 points

F = 0 – 269 points

The instructor reserves the right to curve grades upwards. Extra credit is possible, but will only be granted based on extreme circumstances and after considerable extra effort by the student requesting the credit. Extra credit (up to 25 points) assignments may include, but are not limited to writing reviews of, or performing risk assessments.

**Class Attendance:**

Expected, and highly recommended.

## **GEOG 5300 GEOGRAPHIC INFORMATION SYSTEMS (3 credit hours)**

### **Faculty Information:**

Dr. Kevin R. Mulligan

Office - 208 Holden Hall

[kevin.mulligan@ttu.edu](mailto:kevin.mulligan@ttu.edu)

### **Course Information:**

- **Prerequisites:** Working knowledge of the Microsoft Windows environment.
- **Required Text:** Ormsby *et al.*, 2004, *Getting to Know ArcGIS Desktop, Second Edition*, Environmental Systems Research Institute, Redlands, California. This is a software course book that we will use as the basis for lab instruction. The book includes two CDs - a data CD and a 180-day timed version of ArcGIS 9. If you want to work at home, you will need both CDs and a computer running either Windows 2000 or Windows XP.
- **Other required supplies and financial obligations:** USB Flash Drive. To save your lab work, you need to purchase a USB flash drive early in the semester. Since GIS data can take up a lot of space, a 256 MB flash (or larger) is recommended.  
Required Lab: GEOG 5300 section 501 or 502.

### **Course Description and Purpose:**

Geographic information systems are computer systems designed to manage and analyze spatial data, where spatial data can be any data that are tied to places or geographic coordinates. In this course we will develop a basic understanding of geographic information systems using ArcGIS, a very powerful and widely-used GIS.

### **Course Outline:**

Introduction – What is a Geographic Information System?  
Feature types and data structures (raster vs vector)  
Types of maps (map scale and function)  
Thematic mapping (choropleth, isoline, dot density, proportional symbol)  
Data classification (natural breaks, quantile, defined interval, standard deviation)  
The geographic grid (datums, ellipsoids, spatial reference, latitude and longitude)  
Map projections (getting the Earth onto a flat map – cylindrical, conic and planer projections)  
Projected coordinate systems (UTM coordinate system, state plane coordinate system)  
Land division systems (public land surveys)  
Topographic maps (map interpretation, marginalia and symbolization)  
Effective map design (knowing the purpose of your map)  
Data collection (land surveys, remote sensing, the Global Position System)  
GIS analysis (basic measures, spatial relationships, spatial modeling and map algebra)  
Designing a GIS (database design and implementation)  
Metadata and accuracy (knowing the origins of data)  
Data sources (data in the public domain - working with DEMs, DRGs and DOQs)  
The Spatial Analyst extension to ArcGIS (working with raster data)  
The 3D Analyst extension to ArcGIS (creating animations & 3D fly-throughs)

### **Expected Learning Outcomes:**

- 1) Explain what a GIS is, how it works, and what it can do.
- 2) Analyze spatial data and create publication quality maps using ArcGIS.
- 3) Understand and apply basic cartographic principles (e.g. map projections, symbology and cartographic design).
- 4) Obtain GIS data from Internet sources and evaluate these data in the context of a given project.

### **Criteria for Grading:**

There are two exams in this course (a midterm and a final), two lab quizzes, one basemap project and one final project. Each exam is worth 100 points and each lab quiz is worth 50 points. The basemap project is worth 50 points and the final project is worth 100 points. Your final course grade is therefore based upon a possible total of 450 points. To ensure a grade in this course you must meet the following minimum requirements: A - 90%, B - 80%, C - 70%, D - 60%.

Students are also expected to complete each of the lab assignments **during the lab class time**. Five (5) points will be deducted for each unexcused absence **and** five points will be deducted for each missed or incomplete exercise. Missed or incomplete lab assignments may be turned in late for credit with approval.

**Exams and Quizzes:** The exams and quizzes will consist of a combination of true/false, multiple choice, and short answer questions. The lecture exams will be based upon the lectures and reading assignments. The lab quizzes will be open-book and open-computer based upon the information covered in the labs.

### **Class Attendance:**

You are expected to attend all of the lectures and labs and complete all of the lab exercises in lab. An excused absence does not relieve you of meeting all of the course requirements. If you have any problems during the semester, please let us know.

**Make-Up Exams:** You are required to take the exams and quizzes at the scheduled times. Exceptions will be made in the case of a documented serious illness, medical emergency, or other university approved excuse. If you have prior knowledge that an exam or quiz will be missed, you must inform one of us before the time of the exam or quiz. If you need to make up an exam or quiz, it is your responsibility to make arrangements as soon as possible.

**Missed Information:** If you miss a lab, it is your responsibility to complete the exercise on your own (or with the help of your classmates).



## **GEOG 5301 REMOTE SENSING OF THE ENVIRONMENT (3 credit hours)**

### **Faculty Information:**

Dr. Tina Delahunty

Dept. of Economics and Geography

[tina.delahunty@ttu.edu](mailto:tina.delahunty@ttu.edu)

### **Course Information:**

- **Prerequisites:** None
- **Required Text:**
- Other required supplies or financial obligations-- You are required to enroll in a lab section as part of this class.

### **Course Description and Purpose:**

Remote sensing refers to the acquisition and analysis of imagery (spatial data) obtained using a remote platform, most often an aircraft or satellite. The imagery might be in the form of aerial photographs or the imagery might be digital in the case of airborne or satellite multi-spectral scanners. The purpose of this course is to develop a basic understanding of remote sensing and digital image processing techniques. In the first part of this course we will work with conventional black & white, color, and infrared aerial photographs. In the second part of the course we will work with digital satellite imagery. In particular, this course will focus on the use of remote sensing to solve spatial problems by integrating image processing and GIS analysis. To learn about image processing and geographic information systems, we will use a hands-on approach. In this course we will use the Image Analysis extension to ArcGIS and ERDAS Imagine.

### **Methods for Assessment:**

Learning Outcomes will be assessed by the following methods:

Objective testing (Multiple choice, true-false, and fill in the blank questionnaires), Classroom assessment (Completion of, and performance on, laboratory assignments), and Individual reflection (Creation and presentation of PowerPoints and in-class discussion and debate regarding assignments). Each module of objective testing, classroom assessment and individual reflection is worth 10 points. At the end of the semester all points are totaled and averaged. Be aware that some 10 point assignments are easy and some are difficult. There will be no make-up assignments. If you do not attend a class you will receive a zero for the assignment(s) done or due on that day. 100% attendance is expected. Attendance is taken at the beginning of each class period. One 10-pointer is dropped for each student at the end of the semester. Grade distribution is based on standard 90% and above A, 80% and above B, etc. Performance on the assignments act as evidence that you are making progress in the course and that you are achieving the expected learning outcomes.

### **Expected Learning Outcomes:**

- 1) Understand the sub-discipline's relationship to major geographic principles
- 2) Describe and discuss common uses of raster imagery and be aware of the breadth of disciplines that use remote sensing as a tool to monitor phenomena on the Earth
- 3) Understand the basics of the acquisition of moderate and high resolution raster data
- 4) Understand what the raw pixel data of an image represents on the Earth's surface and the concepts behind viewing imagery in different band combinations
- 5) Locate, download, and manipulate free moderate and high resolution imagery from the Global Land Cover Facility, EROS, TNIRIS, Seamless USGS, and various online county and state organizations
- 6) Perform basic image manipulation in two free remote sensing software packages (Multispec and GRASS)
- 7) Perform advanced image manipulation in ERDAS: a) Interpret raw data in terms of ERDAS pixel data, histograms, and raster attribute options, b) Enhance imagery via contrast stretching and atmospheric correction, c) Perform unsupervised and supervised classification, d) Mask unwanted features from imagery, e) Clip imagery to political or other polygon boundaries, f) Quantify landscape change using image classification and recode techniques, and g) Perform accuracy assessment of classified imagery
- 8) Successfully rectify imagery in ArcGIS and define and reproject raster imagery in ERDAS and ArcGIS
- 9) Successfully import/export various raster image file types
- 10) Create map documents in ERDAS and ArcGIS
- 11) Communicate in remote sensing terminology
- 12) Be painfully aware of software and data compatibility issues

### **Criteria for Grading:**

There are three exams in this course (two midterms and a final) and one final project. Each exam and the final project are worth 50 points. Your final grade is therefore based upon a total of 200 points. You are also expected to successfully complete all of the lab assignments and 10 points

will be deducted for each missed or incomplete exercise. There is no extra credit work in this course. To ensure a grade in this course you must meet the following minimum requirements: A - 90%, B - 80%, C - 70%, D - 60%.

**Exams:** All of the exams will consist of a combination of multiple choice, short answer and short essay questions. The exams will be based upon the lectures, reading assignments and lab exercises. For each exam I will provide a general study guide outlining what the exam will cover.

**Class Attendance:**

You are expected to attend all of the lectures and labs and complete all of the exercises. An excused absence does not relieve you of meeting all of the course requirements. If you have any problems during the semester, please let me know.

## **GEOG 5302 ADVANCED GEOGRAPHIC INFORMATION SYSTEMS**

### **Faculty Information:**

Dr. Kevin R. Mulligan

Office – 208 Holden Hall

[kevin.mulligan@ttu.edu](mailto:kevin.mulligan@ttu.edu)

### **Course Information:**

- **Prerequisites:** Working knowledge of the Microsoft Windows environment and ArcGIS. These requirements can be fulfilled with GEOG 5300 or an equivalent course.
- **Required Text:** none
- **Other required supplies and financial obligations:** USB Flash Drive. To save your work, you will need to purchase a USB flash drive. Given that GIS data can take up a lot of space, a 512 MB flash (or larger) is recommended.  
Required Lab: You are required to enroll in GEOG 5302 - section 501

### **Course Description and Purpose:**

This course is a second course in GIS designed as a continuation of GEOG 5300. The intent of the course is to cover the principle extensions to ArcGIS (Spatial Analyst, 3D Analyst, and Geostatistical Analyst) and related topics dealing with the creation of GIS data, data sources, advanced cartographic techniques and Internet mapping.

### **Course Outline:**

Introduction (course logistics and overview of the ESRI Virtual Campus)  
Working with Rasters in ArcGIS 9 - Raster Basics  
Working with Rasters in ArcGIS 9- Displaying Rasters in ArcMap  
Spatial Analyst - Getting Started with ArcGIS Spatial Analyst  
Spatial Analyst - Analyzing Surfaces  
Spatial Analyst - Working with Map Algebra  
Spatial Analyst - Interpolating Raster Surfaces  
Spatial Analyst - Mapping Distance and Density  
Spatial Analyst - Using Cell, Neighborhood, and Zonal Statistics  
3D Analyst – Introduction to ArcGIS 3D Analyst  
3D Analyst – Displaying 3D Data  
3D Analyst – Symbolizing and Analyzing Data  
3D Analyst – Creating and Converting 3D Data  
3D Analyst – Calculating Raster Surfaces  
3D Analyst – Interpolating Raster Surfaces  
Geostatistical Analyst – Geostatistical Analysis of Rasters  
Working with Internet map services – An introduction to ArcIMS and ArcGIS Server

### **Expected Learning Outcomes:**

- 1) Explain the difference between the vector, raster and TIN data models
- 2) Perform advanced geospatial and geostatistical analyses of raster surfaces
- 3) Apply advanced cartographic techniques in the creation publication quality maps
- 4) Obtain GIS data from Internet sources and evaluate the quality of the data

### **Criteria for Grading:**

Your grade in this course will be based on several factors: 1) successful completion of the ESRI Virtual Campus courses, 2) a midterm exam, 3) completion of assigned exercises, and 4) a final project. To ensure a grade in this course you must meet the following minimum requirements:

A - 90%, B - 80%, C - 70%, D - 60%.

**Exams:** The midterm exam will consist of a combination of multiple choice, short answer and short essay questions. The exam will be based upon the materials covered in the ESRI Virtual Campus courses.

### **Class Attendance:**

You are expected to attend all of the scheduled classes and complete all of the Virtual Campus modules on time. An excused absence does not relieve you of meeting all of the course requirements. If you have any problems during the semester, please let me know.

**Make-Up Exams:** You are required to take the midterm exam at the scheduled time. Exceptions will be made in the case of a documented serious illness, medical emergency, or other university approved excuse

**Missed Information:** If you miss a lab, it is your responsibility to complete the exercise on your own (or with the help of your classmates).

## **GEOG 5309 SEMINAR IN REGIONAL ANALYSIS (3 credit hours)**

### **Faculty Information:**

Dr. Perry Carter

Office - Holden 210

[perry.carter@ttu.edu](mailto:perry.carter@ttu.edu)

### **Course Information:**

- **Prerequisites:** None
- **Required Text:** Reluctant Metropolis: The Politics of Urban Growth in Los Angeles by William B. Fulton Ecology of Fear: Los Angeles and the Imagination of Disaster by Michael Davis Cultural Economy of Cities: Essays on the Geography of Image-Producing Industries by Allen Scott Whitewashed Adobe: The Rise of Los Angeles and the Remaking of Its Mexican Past by William Deverell L.A. City Limits: African American Los Angeles from the Great Depression to the Present by Josh Sides

### **Course Description and Purpose:**

This course is designed as a survey of issues in urban geography. Because urban geography's focus is the city (*a place*) rather than a particular *topic* the course covers a range of topics relevant to cities – politics, economics, culture, gender, ethnicity, urban migration, residential spaces, retail location, urban form, .... Because all these issues co-exist and interact in one place—the city—the main aim of this course will be to understand the linkages among the many topics we study. Simply, we want to understand the city as *a whole* rather than understand specific parts of the city in isolation (its economy, its politics, its culture, etc.).

Urban geography takes a *spatial* approach to understanding cities, and urban geographers want to know where things are, why they are *there*, and why their location is important. Moreover, they are interested in *spatial patterns* in the city—they attempt to describe and explain the city's spatial layout. This *spatial* approach to cities—an approach that strives to understand how people and culture and power and relationships are embedded within the *spaces* of the city—is the defining feature of urban geography. The primary objective of this course is to teach you this spatial approach and to teach you how to critically examine cities.

The aims of this course will be explored using two specific urban examples – Los Angeles and Lubbock. By reading about Los Angeles and going out and studying Lubbock, students will get a better understanding of how to critically (to carefully analyze and interpret) urban landscapes. A secondary goal of this course is to develop students' writing and presentations skills. To further this goal, students will write a 10 page paper and will give a 15 minute power point presentation based on their paper topic.

### **Course Outline:**

Date	Readings (chapters)	Quizzes	Summaries	Emailed questions
1-15				
1-22	Wolch: intro, Deverell: intro-1, Flamming: intro	1	1	1
1-29	Wolch: 1, Deverell: 2, Flamming: 1	2	2	2
2-5	Wolch: 2, Deverell: 3, Flamming: 2	3	3	3
2-12	Wolch: 6, Deverell: 4, Flamming: 3	4	4	4
2-19	Wolch: 5, Deverell: 5, Flamming: 4	5	5	5
2-26	Wolch: 8, Flamming: 5, Gumprecht: intro-1	6	6	6
3-4	Fulton: 1, Flamming: 6, Gumprecht: 2	7	7	7
3-11	Fulton: 2, Flamming: 7-8, Gumprecht: 3	8	8	8
3-18	<b>Spring Break</b>			
3-25	Fulton: 3, Gumprecht: 4	9	9	9
4-1	Fulton: 4, Gumprecht: 5	10	10	10
4-8	Fulton: 5, Gumprecht: 6	11		11
4-15	<b>No Class</b>			
4-22	Fulton: 10 & 11	12		12
4-29	→ [Exam]			
5-5	<b>Final Paper Due in my Office by 5:00</b>			

### **Expected Learning Outcomes:**

This Course has four goals:

1. The development of a spatial view of urban landscapes – the ability to see places as the products of certain economic, social, and cultural decisions and histories as well as locations which derive their meanings via their relationships with other places.
2. The cultivation of a practice of critical thinking – an agnostic and persistently questioning method of thought.

3. Provide students the opportunity to learning by researching.
4. Provide students the opportunity to think through writing – placing a stream of coherent thoughts on a page.

### **Student Learning Outcomes**

### **Assessment Activities**

By the completion of this course student will:

- 1) Demonstrate an understanding of the spatial view
- 2) Show an ability to learn by researching
- 3) Manifest developing critical thinking and evaluative abilities.
- 4) Exhibit a grasp of a variety of urban issues and class discussions

- 1) Final paper
- 2) Final paper
- 3) Emailed questions and class discussion of readings
- 4) Weekly quizzes and summaries,

### **Criteria for Grading:**

Starting the second week of class students must go to the Los Angeles Times ([www.latimes.com](http://www.latimes.com)) and find an article dealing with LA (it can be anything that relates to the city) and type a half page summary of the article. There will be ten of these summaries each worth one point for a total of **10** points towards your final grade.

1. Summaries will be due at the beginning of class.
2. Starting the second week of class students must type a one page, single spaced, summary of that weeks readings. This summary should focus on the main themes of the readings and should include your thoughts on the readings. There will be thirteen weeks of readings and each summary will be worth one point for a total of **13** points towards your final grade
3. Starting the second week of class quizzes over the assigned reading will be given. There are thirteen weeks of readings and thus there will be thirteen quizzes each worth three points for a total of **39** towards your final grade.
4. One exam will be given which will cover everything read or presented in class up until that point. It is worth **14** points towards your final grade.
5. Students are to write a ten (10) page paper which **Must** be in the following format: 1) a cover page with the title of the paper and your name on it (not part of the 10 pages), 2) a bibliography containing all the sources cited in the text of your paper (not part of the 10 pages). You should cite at least 5 sources. 3) the text of you paper must be written in Times New Roman font 12 point (the font and point size used in this syllabus); the margins of the text must be 1 inch on all four sides; and the line spacing must be 1 ½. No matter how good your paper might be if you do not follow this format you will receive a zero on it and forfeit **16** points towards you final grade. Detail about the paper will be given in class.
6. The last two weeks of class each student will give a 15 minute PowerPoint presentation based on their papers. This presentation is worth **8** points towards your final grade. Detail about the presentation will be given in class.

### **Class Attendance:**

Attendance is mandatory.

## **GEOG 5341 DIGITAL IMAGERY IN THE GEOSCIENCES (3 credit hours)**

### **Faculty Information:**

Dr. David Leverington

Office – SC 316

[david.leverington@ttu.edu](mailto:david.leverington@ttu.edu)

### **Course Information:**

- **Prerequisites:** none
- **Required Text:** *Remote Sensing and Image Interpretation*, Lillesand, Kiefer, and Chipman (John Wiley and Sons, Fifth Edition)

### **Course Description and Purpose:**

*Remote sensing* is the gathering of information without actual physical contact with what is being observed. In the earth sciences, this usually involves the use of photography, electronic spectroscopy, or radar to detect and differentiate surface materials.

*Digital Imagery in the Geosciences* is an introductory course in remote sensing. Emphasis is on general remote-sensing principles, including aspects of the nature of electromagnetic radiation, the spectral-response curves of earth materials, and a review of remote-sensing sensors and orbiting platforms. Numerous basic image-processing techniques are covered in this course, including image enhancement, image georeferencing, and image classification. Topics such as planetary remote sensing and the use of remotely-sensed topography in the study of terrestrial surface processes will also be covered.

No previous experience in remote sensing is assumed, although students are expected to have basic skills in computer usage and to have completed introductory mathematics courses at the first-year level. The main software package used in this course is *PCI Geomatica*.

### **Expected Learning Outcomes:**

- 1) Students will have a basic understanding of fundamental remote sensing concepts such as the electromagnetic spectrum, blackbody radiation, atmospheric windows, and spectral response curves.
- 2) Students will have a general appreciation for the history of development of photographic and digital remote sensing technology.
- 3) Students will have an understanding of the different types of digital remote-sensing sensors, including the major optical, thermal, and microwave remote sensing systems that are presently operational.
- 4) Students will understand how to apply basic principles of digital image processing toward the extraction of information from remote-sensing databases; these principles include those of image enhancement, query, filtering, georeferencing, classification, and arithmetic.
- 5) Students will be exposed to basic methods of processing of remotely-sensed topographic databases.
- 6) Students will appreciate the practical value of remote sensing in the study of the Earth as well as in the exploration of other solar system bodies.

### **Criteria for Grading:**

Assessments of learning will be based on three exams and eight (8) lab exercises. Additionally, there will be an optional comprehensive makeup exam that can replace one of the regular exams (e.g., for those who missed an exam earlier in the term, or for those who wish to try to improve their final grade by replacing their poorest exam result with a better result); the makeup exam will cover *all* material covered in the semester. Exams will be based on materials presented in the lectures, labs, and assigned readings. There is no final exam.

Exams will consist of multiple choice questions, fill-in-the-blank questions, and short-answer questions. Multiple-choice sections of exams will be computer scantron graded.

In addition to exams and discussion of exam results, assessments of learning will be made throughout the semester on the basis of periodic non-graded quizzes, and through discussion in labs and lectures.

The final course grade will be based on A) the best 3 exam results, with each exam worth 20% of the final grade (total = 60% of final grade); and B) the 8 lab exercises, with each lab worth 5% (total = 40% of final grade); unless otherwise noted these exercises will be due one week after the relevant lab, and will be penalized 20% per late day.

The grading scale is as follows:

A (90-100%); B (75-89.99%); C (60-74.99%); D (50-59.99%); F (0-50%).

## **GEOL 5342 SPATIAL DATA ANALYSIS AND MODELING IN GEOSCIENCES (3 credit hours)**

### **Faculty Information:**

Dr. Seiichi Nagihara

Dept. of Geosciences [seiichi.nagihara@ttu.edu](mailto:seiichi.nagihara@ttu.edu)

### **Course Information:**

- **Prerequisites:** GEOL 3428/5428 or GEOG 3300/5300, and Statistical Methods (MATH 2300) or equivalent
- **Required Text:** *An Introduction to Applied Geostatistics*, E.H. Isaaks and R.M. Srivastava, Oxford University Press (**required**)  
*Data in Three Dimensions: A Guide to ArcGIS 3D Analyst*, H. Kennedy, OnWord Press (**required**)

### **Course Description and Purpose:**

In this course, students will learn advanced techniques in GIS-based data interpretation, statistical analyses, and geospatial modeling. It is designed for researchers and practitioners who deal with a large volume of geologic, atmospheric, and other environmental data sets. The fundamental theories behind the analytical and modeling techniques are covered in detail. The theoretical knowledge will be enforced by a series of computer exercises, using real geological and environmental data. *ArcGIS* (Environmental Systems Research Institute, Inc.) and its extensions (*Geostatistical Analyst*, *Spatial Analyst*, and *3-D Analyst*) will be the primary GIS software tool for the exercises. We will also use *Microsoft Excel* for exercises in statistics.

### **Course Outline:**

#### **Expected Learning Outcomes:**

1. To determine basic geospatial relationship (direction, distance, area size, elevation/altitude, volume etc.) of objects displayed in 3-D perspectives on computers.
2. To produce maps in 3-D perspectives on computers, if given necessary geospatial datasets.
3. To perform univariate and bivariate statistical analyses applied to geographically referenced data.
4. To understand the fundamental theories of spatial interpolation.
5. To perform surface interpolation of geographically reference data.
6. To perform model simulations on hydrologic processes.

#### **Criteria for Grading:**

Students will be graded on their performances in four sets of homework assignments. Each assignment must be turned in by the prescribed deadline. Each assignment consists of technical questions related to the course material covered and computer exercises.

	Time Allowed	Percentage contribution to the Final Grade
HW1	2.5 weeks	25%
HW2	2.5 weeks	25%
HW3	2.5 weeks	25%
HW4	2.5 weeks	25%

Grade Breakdown A ( $\geq 85\%$ ), B ( $\geq 70\%$ ), C ( $\geq 55\%$ ), D ( $\geq 40\%$ ), F ( $< 40\%$ )

#### **Class Attendance:**

Attendance is required although not part of the final grade.

**NRM 5310 ADVANCED RANGE ECOLOGY (3 credit hours)**

**Instructor:** Robert D. Cox

Office 09C, Goddard Building

742-2841 (Office)

Office Hours: 9:30-12:30 Monday, Wednesday, Thursday

or by appointment

**Course Purpose:**

An in-depth exploration of plant ecology theories and their application to the species and

community levels. Individual environmental parameters and the plant's and community's response

to these parameters will also be discussed, particularly as relating to arid and semi-arid

environments and rangelands.

**Expected Learning Outcomes:**

At the end of the course, students should:

A. Understand how the history of plant ecological theory informs our current understanding:

Trace the development of ecological thought through time, and how discuss how one's background and experiences may influence their ecological thought.

Recognize major ecologists working today, as well as some of the ecologists who have influenced modern ecological thought.

B. Understand major plant communities of the world, with special focus on the United States:

Be able to recognize the major plant communities of North America and their geographical location.

Be able to describe the dominant plants, soils, and climate regime of each major plant community.

C. Understand the basics of prevailing world climates and climate change.

Describe the distribution of world climates and the causes of major climatic patterns.

Be able to associate specific plant formations with specific climatic regimes.

Understand the importance of climate and weather in influencing plant communities.

D. Be familiar with the environmental complex and selection of ecotypes best suited to particular environments:

Describe how the complexity of the environment, including climates and soils, influences plant communities and species.

Describe the adaptability of ecotypes to specific environmental regimes.

E. Understand resource allocation in plants as a response to varying environmental factors and management implications:

Be able to describe resource (i.e., energy) allocation in plants.

Define how plants are capable of responding to environmental cues and changing regimes.

Understand r- and k- selected life history patterns and their ecological relationships.

F. Understand how plants interact with each other:



Be able to describe different types of plant-plant interactions and how each interacting

member is affected.

Describe how plant interactions influence community development.

G. Gain a thorough understanding of plant succession:

Differentiate between primary and secondary succession.

Understand seral and climax stages.

Understand different models of community succession and change.

H. Understand energy budgets, energy relations, and water use by native plants:

Understand energy budgets and the inter-relationships of energy budget components

Understand plant responses to high and low temperatures.

Understand light influences on the vegetation, and how the vegetation influences the light within the community.

Understand C3, C4, and CAM photosynthetic pathways and their ecological relationships.

Understand water potentials and transpiration in natural environments.

**NRM 5322 ADVANCED NONGAME ECOLOGY AND MANAGEMENT (3 credit hours)****Faculty Information:**

Dr. Clint Boal

Office - 218 Agriculture Sciences

[clint.boal@ttu.edu](mailto:clint.boal@ttu.edu)**Course Information:**

- **Prerequisites:** NRM 2301 or consent of instructor
- **Required Text:** Assigned readings only. Copies of assigned readings will be placed on reserve.

**Course Description and Purpose:**

Wildlife Management in North America was originally based on game management. Evolving social viewpoints, improved understandings of biotic community health and ecosystem stability, the value of biodiversity, and shifting social attention on non-consumptive uses of wildlife resulted in nongame conservation and management. This course introduces graduate students to the issues relating to nongame species and their conservation. We will briefly review basic principles of wildlife management for a common frame of reference. We will then survey selected species and species groups, their environments, the conservation issues facing them, and management approaches taken. The semester will draw heavily on assigned readings followed by discussions. Quizzes will follow assigned readings.

**Course Outline:**

Month	Day	Topic	Assigned Readings	
Jan	12	Nongame Intro		
Jan	17	Who manages wildlife		
Jan	19	<b>No class</b>		
Jan	24	Legislation		
Jan	26	Endangered Species Act	Morrow et al. 2004,	<b>Quiz</b>
Jan	31	Wolves of Yellowstone	Handout	
Feb	2	Populations	Caughley and Sinclair Chp 4	<b>Quiz</b>
Feb	7	Conservation Genetics		
Feb	9	Monitoring Overview	Handout	
Feb	14	<b>EXAM I</b>		
<b>Feb</b>	<b>16</b>	<b>TWS Meeting</b>	<b>no class</b>	
Feb	21	Bird Migration		
Feb	23	Passerine Bird Declines		
Feb	28	Fragmentation studies	Franklin et al. 2002, Faaborg 2002	<b>Quiz</b>
Mar	2	NA birds	Askins Chp 2&3	<b>Quiz</b>
Mar	7	NA birds	Askins Chp 5&6	<b>Quiz</b>
Mar	9	NA birds	Askins Chp 8&9	<b>Quiz</b>
<b>Mar</b>	<b>14</b>	<b>Spring break</b>	<b>no class</b>	
<b>Mar</b>	<b>16</b>	<b>Spring break</b>	<b>no class</b>	
Mar	21	Raptors	TBA	<b>Quiz</b>
Mar	23	<b>EXAM II</b>		
Mar	28	Amphibian&Reptiles	Semlitsch 2000	<b>Quiz</b>
Mar	30	Amphibian&Reptiles	TBA	
Apr	4	Focus: <i>Atrox</i>	Beaupre and Duvall 1998, Fitzgeralds and Painter 2000	<b>Quiz</b>
Apr	6	Mammals	Mattson 2004, Nie 2004	<b>Quiz</b>
Apr	11	Focus: <i>Chiroptera</i>	Grad Presentation	
Apr	13	Focus: <i>Urocyon &amp; Vulpes</i>	Grad Presentation	
Apr	18	Focus: <i>Dipodomys</i>	Grad Presentation	
Apr	20	Urban Wildlife	Bolen and Robinson Ch 17	<b>Quiz</b>
Apr	25	Urban Wildlife	Gehrt 2004, Mannan and Boal 2004	<b>Quiz</b>
Apr	27	Wildlife Rehabilitation	TBA	
<b>May</b>	<b>2</b>	<b>Last Day</b>		

Although this is not a writing intensive course, **it is reading and discussion intensive.**

**Expected Learning Outcomes:**

1. Demonstrate an understanding of basic wildlife management history and principles and how they relate to nongame species conservation. This will include:
  - The history of wildlife management and legislation in the United States
  - Population growth and limitations
  - Influences of habitat and habitat change
  - Community structure and dynamics
2. Demonstrate an understanding of basic monitoring and inventory methods, and the inherent biases, used for nongame birds, mammals, reptiles and amphibians.
3. Demonstrate an understanding of causes of declines of selected North American nongame bird species in different environments, and the conservation approaches taken.
4. Demonstrate an understanding of migration ecology, and the conservation issues concerning bats and neotropical migrant birds.
5. Demonstrate an understanding of conservation issues concerning North American reptiles and amphibians.
6. Demonstrate an understanding of conservation issues, causes, and management approaches concerning declining species of selected North American nongame mammals

**Criteria for Grading:**

Exams will be from lecture notes, presentations, videos, and reading assignments. All exams will be comprehensive. Point values are as listed below.

Assignments and Exams	Points	% of grade	Points	Letter Grade
Exam I	100	22	405	= A
Exam II	100	22	360	= B
Final Exam	150	33	315	= C
Class Project (Individual Component)	50	11	270	= D

Class Project (Total Project)	25	6	< 270	= lets not go there
Assigned Lecture	25	6		
Total Points Available	450	100		

**Meeting:** Each student will schedule a 10 minute meeting with the instructor prior to the first exam.

**Quizzes:** Quizzes will be given following 12 reading assignments. The lowest 2 scores will be dropped.

**Class Attendance:**

Class attendance is expected. Excessive absences (>3/month) without discussion with the instructor is grounds for dropping you from the class. In the event of excessive absences, the student must visit the instructor to discuss his or her status in the course. If the drop occurs before the 45th class day of the long semester or the 15th class day of the summer term, the instructor will assign a grade of W (see sections on dropping a course and on withdrawal). If the drop occurs after that time period, the student will receive a grade of F. This drop can be initiated by the instructor but must be formally executed by the academic dean. In extreme cases the academic dean may suspend the student from the university.

**Make-up exams:** Make-up exams will usually not be given. Arrangements must be made with the instructor in advance. If you do not do so, you will receive 0 points for that exam.

**NRM 5404 AERIAL TERRAIN ANALYSIS (4 credit hours)**

**Faculty Information:**

Dr. Ernest B. Fish

Office - Room 102B Goddard Building [ernest.fish@ttu.edu](mailto:ernest.fish@ttu.edu)

**Course Information:**

- **Prerequisites:** None
- **Required Text:** Campbell, J. B. 2002. Introduction to Remote Sensing. Third Edition. Guilford Press. New York, New York. 620 pp.  
Wanless, H. R. 1973. Aerial Stereo Photographs. Hubbard Press. Northbrook, Illinois. 92p.

**Course Description and Purpose:**

To provide the student an introductory knowledge of the principles of photogrammetry, geographic information systems, global positioning systems, and fundamentals of aerial photograph reading, interpretation, and evaluation with emphasis on and application to the management of renewable natural resources.

**Course Outline:**

- I. Introduction
  - A. Historical Background
  - B. Terminology
- II. Factors Influencing the Aerial Photograph
  - A. The Aerial Camera
  - B. The Camera Mounting
  - C. Filters
  - D. The Film
    - 1. General Film Construction
    - 2. Film Processing and Printing
  - E. Atmospheric Conditions
  - F. Surficial Characteristics
    - 1. Optical Properties
    - 2. Physical Properties
- III. Characteristics of Aerial Photographs
  - A. Vertical Photographs
    - 1. Scale
    - 2. Effective area
    - 3. Marginal Information
    - 4. Radial Displacement
    - 5. Flight Planning
  - B. Oblique Photographs
    - 1. Types
    - 2. Scale
    - 3. Uses
- IV. Stereoscopy - Stereoscopic Study of Aerial Photographs
  - A. Properties of Human Vision
  - B. The Stereoscopic Image
  - C. Parallax
  - D. Types of Stereoscopes
  - E. Pseudoscopic Images
  - F. Preparation for Stereoscopic Viewing
- V. Basic Photogrammetric Techniques
  - A. Radial Line Triangulation
    - 1. Theory
    - 2. General Methodology
    - 3. Types of Templates
    - 4. Radial Planimetric Plotter
    - 5. Sketchmaster Devices
  - B. Topographic Mapping
    - 1. Techniques
    - 2. The Kelsh Plotter
- VI. Characteristics of Digital Imagery
  - A. Sensor Systems
    - 1. Landsat
    - 2. SPOT
  - B. Digital Image Analysis
    - 1. Manual
    - 2. Computer Assisted
- VII. Geographic Information Systems (GIS)
  - A. Theory
  - B. Applications and Examples
- VIII. Global Positioning Systems (GPS)
  - A. Theory
  - B. Applications and Examples
- IX. General Principles of Photo-Interpretation
  - A. Introduction
  - B. Diagnostic Characteristics of Images
  - C. Photo-Interpretation Aids
- X. Integrated Photographic Interpretation Applications
  - A. Introduction
  - B. Geographic Considerations

- C. Geologic Considerations
- D. Geomorphic Considerations
  - 1. Landform Analysis
  - 2. Drainage Pattern Analysis
  - 3. Soil Considerations
- F. Vegetative Considerations
- G. Hydrologic Considerations
- H. Land Use Considerations

**Expected Learning Outcomes:**

1. To provide the student with a perspective of the historical development and current status of the fields of photogrammetry and photo interpretation.
2. To provide the student with a basic knowledge of the factors influencing the quality characteristics of aerial photography.
3. To provide the student with a basic understanding of photogrammetric principles and operations
4. To provide the student with a basic understanding of photo image interpretation principles and their specific applications in various areas of study
5. To provide the student with a basic understanding of digital image analysis.
6. To provide students with a basic understanding of Geographic Information Systems (GIS) and current GIS technology.
7. To provide students with a basic understanding of Global Positioning Systems (GPS) and current GPS technology.

**Criteria for Grading:**

Graded material will consist of 2 mid-term exams and a final exam all of which carry an equal weight and are comprehensive in nature (100 points each). Additionally, laboratory exercises will be graded and there will be laboratory quizzes which are unannounced. These exercises and quizzes usually constitute approximately 200 points. Total point accumulation for the entire course is normally 550-650.

Letter grades for the course are based upon the following percentage categories applied to the total available number of points during a semester.

Student must pass the final exam to receive a passing grade for the course.

<b>A</b>	<b>90-100</b>
<b>B</b>	<b>80 - 90</b>
<b>C</b>	<b>70 - 80</b>
<b>D</b>	<b>60 - 70</b>
<b>F</b>	<b>&lt;60</b>

## **NRM 6303 IMAGERY INTERPRETATION FOR NATURAL RESOURCE (3 credit hours)**

### **Faculty Information:**

Dr. Ernest B. Fish

Office - Room 9 Goddard Building

[ernest.fish@ttu.edu](mailto:ernest.fish@ttu.edu)

### **Course Information:**

- **Prerequisites:** RWFM 4403 or RWFM 5404 or equivalent course
- **Required Text:** Campbell, J. B. 1996. Introduction to Remote Sensing. Second Edition. Guilford Press. New York, New York. 622 pp.  
Wanless, H. R. 1973. Aerial Stereo Photographs. Hubbard Press. Northbrook, Illinois. 92p.

### **Course Description and Purpose:**

To provide the student knowledge of geographic information systems, remote sensing imagery systems and fundamentals of imagery reading, interpretation, and evaluation with emphasis on and application to the management of renewable natural resources.

### **Course Outline:**

#### I. Introduction

##### A. General

##### B. Review of Photogrammetric Principles

1. Scale determinations and horizontal measurements
2. Height determinations
  - a. Single vertical photographs
  - b. Vertical stereo pairs
3. Area determinations
4. Stereoscopy
  - a. Airbase
  - b. Stereoscope focal length
  - c. Flying height
  - d. Camera lens focal length
  - e. Preparation for stereo viewing

#### II. Principles and Theories of Image Interpretation

##### A. Levels of examination

1. Image reading
2. Image analysis
3. Image interpretation

##### B. Diagnostic characteristics of images

1. Shape or configuration
2. Shadow
3. Tone, shade, color contrast
4. Pattern
5. Texture
6. Surroundings or association
7. Size

##### C. Levels of detail

1. Reconnaissance
2. Semi-detailed
3. Detailed

##### D. Interpretation Sequence

1. Data collection
2. Synoptic overview
3. Preliminary interpretation
4. Detailed

interpretation

5. Formation of conclusions

##### E. Miscellaneous considerations

1. Backgrounds
2. Training
3. Experience

#### III. Imagery Producing Systems

##### A. Photographic

1. Black and white
  - a. General photographic theory
  - b. Photographic properties
    - (1) Sensitometric
    - (2) Image structure
      - Color
      - Color theory
      - Photographic properties

##### 3. Color infrared

- a. Infrared theory
- b. Photographic properties

##### 4. Black and white infrared

##### B. Thermal Imagery

1. Thermal theory
2. System functions
3. Image characteristics

##### C. Radar (S.L.A.R.) Imagery

1. Radar theory
2. System functions
3. Image characteristics

##### D. Multispectral Scanners

1. Multispectral theory
2. System functions

- 3. Data characteristics
  - a. Imagery
  - b. Electromagnetic
- IV. Digital Image Analysis
  - A. Manual
  - B. Computer assisted
    - 1. Statistics extraction    2. Display alternatives    3. Image enhancement    4. Thematic extraction
- V. Geographic Information Systems
  - A. Characteristics
  - B. Applications
- VI. Global Positioning Systems (GPS)
  - A. Theory and Characteristics
  - B. Applications and Examples
- VII. Integrated Interpretation and Applications
  - A. General
  - B. Agricultural Applications
    - 1. Soils mapping
    - 2. Land use classification
    - 3. Land capability classification
    - 4. Erosion surveys
    - 5. Salinity surveys
    - 6. Irrigation surveys
    - 7. Crop yield surveys
    - 8. Crop stress detection
  - C. Forestry, Botany, Ecology Applications
    - 1. Temperate zone forestry                      2. Tropical zone forestry                      3. Botany - Ecology
  - D. Urban and Regional Studies Applications
    - 1. Urban planning                      2. Urban operations                      3. Regional planning                      4. Regional

operations

#### VIII. Summary

#### **Expected Learning Outcomes:**

- 8. To provide the student with a perspective of the historical development and current status of the field of remote sensed imagery.
- 9. To provide the student with a basic knowledge of the factors influencing the quality characteristics of remote sensed imagery.
- 10. To provide the student with a basic understanding of image interpretation principles and their specific applications in various areas of study.
- 11. To provide the student with a basic understanding of digital image analysis.
- 12. To provide the student with a basic understanding of Geographic Information System technology.
- 13. To provide students with a basic understanding of Global Positioning Systems (GPS) and current GPS technology.

#### **Criteria for Grading:**

Graded material will consist of 2 mid-term exams and a final exam all of which carry an equal weight and are comprehensive in nature (100 points each).

## **NRM 6305 GEOSPATIAL TECHNIQUES IN NATURAL RESOURCE (3 credit hours)**

### **Faculty Information:**

Dr. Ernest B. Fish                      Dept. of Natural Resources Management

### **Course Information:**

- Prerequisites: None
- Required Texts: -Chrisman, Nicholas. 1997. Exploring Geographic Information Systems. John Wiley and Sons, Inc. New York. 298p.  
-Ormsby, T., E. Napoleon, R. Burke, C. Groessl and L. Feaster. 2004. Getting to know ArcGIS desktop: basics of ArcView, ArcEditor, and ArcInfo. 2nd ed., updated for ArcGIS 9. ESRI Press. Redlands, California.
- Course Purpose: To provide the student an introductory knowledge of the principles of Geographic Information Systems and Global Positioning Systems. Applications for natural resource inventory, planning, and management will be emphasized.

### **Course Objectives:**

1. To provide the student with a perspective of the historical development and current status of Geographic Information Systems and Global Positioning Systems technologies.

Expected Learning Outcomes:

- a. Be able to define and understand the specific technical terminology involved in the fields of Geographic Information Systems and Global Positioning Systems.
  - b. Be able to identify suitable applications for Geographic Information Systems and/or Global Positioning Systems for the solution of renewable natural resource management problems.
2. To provide students with a basic understanding of Geographic Information Systems (GIS) and current GIS technology.

Expected Learning Outcomes:

- a. Be able to define and discuss the characteristics of a Geographic Information System.
  - b. Be able to demonstrate an application of a Geographic Information System in the practical solution of a natural resource planning or management situation.
3. To provide students with a basic understanding of Global Positioning Systems (GPS) and current GPS technology.

Expected Learning Outcomes:

- a. Be able to identify and discuss the functional components of a Global Positioning System.
- b. Be able to use Global Positioning Systems equipment in a practical solution of a natural resource planning or management situation.

### **Criteria for grade determination:**

Graded material will consist of an hourly midterm examination and a final exam each worth 100 points. Additionally, laboratory exercises and quizzes will constitute approximately 200 points. 200 points are allocated to class attendance and class participation. Total point accumulation for the entire course is normally 600 points.

Letter grades for the course are based upon the following percentage categories applied to the total available number of points during a semester.

A	90 - 100
B	80 - 90
C	70 - 80
D	60 - 70
F	<60



## **PSS 5329 PRECISION AGRICULTURE (3 credit hours).**

### **Faculty Information:**

Dr. Stephen Maas

Dept. of Plant and Soil Sciences

[stephen.maas@ttu.edu](mailto:stephen.maas@ttu.edu)

### **Course Information:**

- **Prerequisites:** None
- **Required Text:** None

### **Course Description and Purpose:**

Introduction to site-specific management of agricultural crops emphasizing collection and use of geospatial information in performing variable-rate farming practices.

### **Expected Learning Outcomes:**

At the completion of this course, the student should be able to:

1. Understand how to operate a GPS,
2. Understand how yield monitors work,
3. Understand how to sample a field for soil characteristics,
4. Understand how remote sensing can be used in site-specific farming,
5. Understand how to use a GIS for on-farm applications,
6. Understand how to use integrated pest management on a site-specific basis,
7. Understand how to use variable-rate equipment and autosteer.

### **Methods for Assessing Expected Learning Outcomes:**

The expected learning outcomes for the course will be assessed with periodic class assignments and a final exam.

### **Course Assignments and Grading Procedures:**

- A. There will be several class assignments and a comprehensive final exam. The final exam may contain a variety of question types, including definitions, essay, and computational problems. The final exam is scheduled at the time specified by the University for this class.
- B. Class assignments will consist of problems or exercises to be completed by the student.

### **Grades**

Class Assignments (100 pts.) + Final Exam (100 pts.) = TOTAL (200 pts.)

### **Point Distribution**

A =	200 – 180	(90-100%)
B =	179 – 160	(80-89%)
C =	159 – 140	(70-79%)
D =	139 – 120	(60-69%)
F =	0 - 119	(0-59%)

### **General Information:**

- A. No make-up exams will be given, except for University-approved absence.
- B. Extra credit may be offered at the discretion of the Instructor.
- C. "The University is committed to the principle that in no aspect of its programs shall there be differences in the treatment of persons because of race, creed, national origin, age, sex, or disability, and that equal opportunity and access to facilities shall be available to all. If you require special accommodations in order to participate, please contact the instructor. Students should present appropriate verification from "AccessTECH" located in the Counseling Center. No requirement exists that accommodations be made prior to completion of this approved University process." The URL for AccessTECH is <http://www.accesstech.dsa.ttu.edu/default.asp>
- D. Integrity and professionalism are expected at this level of education. Collaboration on assignments other than as specified, as well as dishonesty on exams, will not be tolerated. The guidelines set forth by the University will be followed with any infraction.
- E. Regular class attendance is encouraged.

## **PSS 5333 SOIL AND PLANT RELATIONSHIPS (3 credit hours)**

### **Faculty Information:**

Dr. Robert J. Lascano      USDA-ARS, 3810 4th Street, Lubbock, TX

[r-lascano@tamu.edu](mailto:r-lascano@tamu.edu)

### **Course Information:**

- **Prerequisites:** Must be approved by instructor.
- **Required Text:** Given the interdisciplinary nature of this course no specific text is assigned to this class. Pertinent reference material is photocopied and distributed to students. Students are encouraged to purchase the student version of MathCad to solve homework assignments.

### **Course Description and Purpose:**

This class teaches students in agronomy and associated disciplines about the physical principles and concepts as they relate to transport of *water* and *energy* in a soil-plan atmosphere system. Emphasis is given to measurement techniques and instrumentation of environmental parameters. The following is a general guideline used for each lecture.

- Outline of each lecture will be given to students.
- A suggested reading will be given for each lecture.
- Assigned readings will be given for each lecture with a required summary
- Assignment of problems (homework).

This course is to familiarize students with the basic concepts related to productivity and water management of agricultural systems. In addition, students are given pertinent literature related to the subject matter and are asked to provide synthesis of several journal articles. These are assigned based on the student's interests and background. Parts of the subject matter are specific to the interest and needs of the students.

### **Course Outline:**

This is outline is subject to change and is modified to the specific needs and interests of the students that take this class.

1. Introduction of Materials and Basic Concepts
  - Introduction of course, instructor and students
  - Explanation to students of examinations, term paper, assignments, grades, etc.
2. Basic Physical Concepts
  - I. Explanation of basic physical concepts, definitions and units
    - a. Work, Pressure, Power, Mechanics, Water Potential
    - b. S.I. Units
    - c. The concept of a *flux*
3. Scientific Principles and Measurement Techniques
  - a. Accuracy vs. precision
  - b. Error in measurement
  - c. Spatial variability
  - d. Significant digits
4. Soil Water and Related Terms and Different Measurement Techniques
  - Gravimetric and volumetric methods
  - Direct vs. indirect methods
  - Soil hydraulic properties, i.e., water potential and hydraulic conductivity
5. Measurement of Environmental Parameters (irradiance, air temperature and humidity, & wind speed).
  - Instrumentation
  - Concept and calculation of potential evapotranspiration
  - Weather networks and the use of PET to calculate daily values of evapotranspiration
- 6 — 7. Water and Energy Balance, and Calculation of Fluxes
  - Temperature, sensible heat
  - Humidity, latent heat
  - Radiation, radiant energy
  - Gaseous diffusion
  - Energy balance of a leaf
- 8 — 9. Soil-Water Balance of a Bare Soil (Concepts and Applications)
  - Law of conservation of matter
  - Inputs and outputs
  - Integral form of the water balance equation
  - Models of the soil water balance:
  - General flow equation-Richard's equation

- Water Infiltration and evaporation from a bare soil
10. Energy and Water balance of a Soil-Plant System (Concepts and Examples)
- Radiative energy transfer
  - Energy balance of the plant canopy
  - Energy balance of the soil surface
  - Root water uptake
- 11 — 12. Water Requirements of Crops and Irrigation
- Precision farming (systems)
  - Variable rate technologies
- 13 — 14. Student Presentations
- Oral presentations of term papers.

#### **Expected Learning Outcomes:**

Upon completion of this course, the students will be able to:

- A. Have a general understanding of the factors that affect the energy and water balance of bare soil and cropped surfaces.
- B. Have analytical skills to take weather information and calculate the potential evapotranspiration in reference to water requirement of crops.
- C. Quantitative understanding of soil water in relation to crop water requirements.
- D. Be able to apply theoretical concepts to practical applications of factors that affect crop production.

#### **Criteria for Grading:**

- A. **Weekly homework assignments.** In these assignments students must answer open-ended questions and solve problems related to the subject of the weekly lectures. Students are encouraged to correct mistakes and return assignment for further verification. Students are encouraged to work as a team as a means to understand and comprehend difficult concepts. These homework assignments represent 20% of the final grade. All homework assignments with no exception are due a week after (7 days) given out in class.
- B. **Mid-term exam.** An open book take home exam is given on the material covered in the first half of the class. Several questions are open-ended to allow students to search for information not necessarily given in class. This exam represents 15% of the final grade.
- C. **Weekly reading assignments.** Every week students are given 2-3 journal articles and they are requested to provide a critical synthesis or summary of the paper. This also allows student's to practice technical writing. These assignments are 15% of the final grade. All reading assignments with no exception are due a week after (7 days) given out in class.
- D. **Term paper and Presentation.** Students are requested to write a short term paper on a subject matter of their choice that is related to the content of the course. Also, students give a 12-15 minute oral presentation to the class on their term paper. This term paper and oral presentation represent 20% of the final grade.
- E. **Final Exam.** A comprehensive open book exam is given at the end of the class. This exam follows the same format as that of the mid-term exam and represents 15% of the final grade.
- F. **Attendance and Student in-class participation.** Class attendance and in-class discussion is encouraged and expected of all students. This component represents 15% of the final grade.

#### **Grades:**

Class attendance and participation 15%

Homework assignments 20%

Reading assignments 15%

Mid-term (open book) 15%

Class presentation (written and oral report) 20%

Take-Home open book final exam 15%

### **PSS 5334 SOILS AND CROPS IN ARID LANDS (3 credit hours)**

#### **Faculty Information:**

Dr. Kevin Bronson      Office : Room 7, Texas A&M Res & Extn Cntr      [kevin.bronson@ttu.edu](mailto:kevin.bronson@ttu.edu)

#### **Course Information:**

- **Prerequisites:** Introductory Soils
- **Required Text:** No one specific, chapters from multiple books provided as pdfs

#### **Course Description and Purpose:**

Overview of the soils, climate, geography, and cropping systems of arid and semiarid regions of the world. Soil and crop management topics specific to dry regions and case studies from six arid/semiarid countries are addressed..

#### **Course Outline:**

Introduction to arid/semiarid regions

Saline/sodic soil management  
Water management  
Nutrient management  
Conservation tillage  
Erosion and CRP  
Soil carbon management  
Precision agriculture  
Animal waste management  
Wastewater and biosolids  
West Texas case study  
Eastern Colorado case study  
Western Australia case study  
Israel Negev case study  
Pakistan case study  
Uzbekistan case study  
Afghanistan case study

**Expected Learning Outcomes:**

Students should understand and be able to discuss the following topics:

Definition of arid and semiarid regions  
Saline/sodic soils and management  
Water management in arid/semiarid regions  
Nutrient management in arid/semiarid regions  
Conservation tillage in arid/semiarid regions  
Erosion and CRP  
Soil carbon management  
Precision agriculture in arid/semiarid regions  
Animal waste management in arid/semiarid regions  
Wastewater and biosolids in arid/semiarid regions  
West Texas soils and crops  
Eastern Colorado soils and crops  
West/Central Asia soils and crops  
Western Australia soils and crops  
Israel Negev soils and crops

**Criteria for Grading:**

25 % mid-term, 25 % final, 25 % term paper and presentation, 25 % class participation

**Class Attendance:**

Required, no more than two absences, read assigned readings before class

# **Appendix B**

## **Faculty CVs**

## **Dr. Vivian Allen**

### **Education**

- Ph.D. Louisiana State University. 1979. Agronomy. Minor: Animal Science.
- M. S. Louisiana State University. 1973. Agronomy. Minor: Animal Science.
- B.S. University of Tennessee, Martin. 1962. General Agriculture. Minor: Music.

### **Professional Experience**

- Thornton Chair and Horn Professor. Department of Plant and Soil Science. Texas Tech University. 1995-present.
- Owner/Manager. Feliciano Farms. Huntland, TN. 1970-present.
- Professor. Department of Crop and Soil Environmental Sciences. Virginia Polytechnic Institute and State University. 1993-95.
- Associate Professor of Agronomy. Virginia Polytechnic Institute and State University. -1986-93.
- Assistant Professor. Virginia Polytechnic Institute and State University. 1980-86.
- Post-doctoral Fellow. Louisiana State University. 1980.
- Research Assistant. Louisiana State University. 1978-79.

### **Professional Service (selected examples)**

- Former President, American Forage and Grassland Council. 1992-93.
- Former President, Crop Science Society of America. 2001-02.
- Current Chair, International Grassland Congress Continuing Committee. 2001-05.
- Board of Trustees, Agronomic Science Foundation. 2004-07.
- Baker Endowment Advisory Council Member. Iowa State University. 2004.

### **Principal Research Interests**

-Forage production, management, and physiology with primary interest in forage quality and antiquality factors and animal response. Grazing, metabolism, and feeding trials with animals. Forage management and forage/livestock systems with emphasis on maximizing use of forages for animal production, nutrient management and recycling to enhance sustainability of the forage/livestock system, and integrating grazing animals into sustainable forage/livestock /cropping systems. Mineral imbalances in the soil/plant/animal system, especially as related to sulfur, nitrogen, aluminum, phosphorus, magnesium, copper and antiquality components of forages. Salinity tolerance of forage crops and use of forages to remediate saline and nutrient challenged land.

### **Selected Publications**

- Allen, V. G., R. Heitschmidt, and L. E. Sollenberger. 2004. Grazing systems and strategies. *In: Forages: Volume II. The Science of Grassland Agriculture*. R. F. Barnes, C. J. Nelson, M. Collins, and K. J. Moore. (Eds.). Iowa State Press/Blackwell Publishing Company, Ames, Iowa. 6<sup>th</sup> Edition.
- Allen, V. G. and co-authors. 2004. 6<sup>th</sup> Annual field tour of an integrated crop/forage/livestock systems approach for the Texas High Plains. Project summaries and other related research studies. Field Day Report. Jun. 18.
- Craddock, W. C., A. A. Hopkins, V. G. Allen, and P. Brown. 2004. Cool-season perennial grasses for the Southern Great Plains. Annual meeting of the Tri-Societies. Seattle, WA. Oct. 31 Nov. 4. CD-ROM.
- Allen, V. G. and K. R. Pond. 2004. Direct feeding of seaweed supplement to cattle and swine to enhance carcass quality. US Patent Number 6,689,376 B2. Date of Issue Feb. 10.
- Pond, K. R. and V. G. Allen. 2004. Reducing E. Coli content of beef. Australian Patent Number 2001232751. Date of Issue Jul 8.
- Allen, V. G., K. R. Pond, K. E. Saker, and J. P. Fontenot. 2004. Seaweed supplement diet for enhancing immune response in mammals and poultry. US Patent Number 6,764,691 B2. Date of Issue Jul. 20.

(Full CV at <http://www.pssc.ttu.edu/personnel/vallen/VivienAllenCV.pdf>)

## **Dr. Clint Boal**

### **Education**

- Ph.D. 1997. Wildlife Ecology. University of Arizona, Tucson, AZ. Dissertation Title: The Urban Environment as an Ecological Trap for Cooper's Hawks.
- M.S. 1993. Wildlife Ecology. University of Arizona, Tucson, AZ. Thesis Title: Food Habits of Northern Goshawks on the Kaibab Plateau.
- B.S. 1990. Renewable Natural Resources, University of Arizona, Tucson, AZ.

### **Professional Experience**

- 2000 - present: Assistant Leader, USGS Texas Cooperative Fish and Wildlife Research Unit
- 2006 - present: Research Associate Professor - Wildlife Ecology, Texas Tech University, Lubbock, TX.
- 2000 - 2006: Research Assistant Professor - Wildlife Ecology, Texas Tech University, Lubbock, TX.
- 1998 - 2000: Post-doctoral Research Fellow, USGS Minnesota Cooperative Fish and Wildlife Research Unit, University of Minnesota, St. Paul, MN.
- 1997 - 1998: Research Assistant, University of Arizona, Tucson, AZ.

### **Professional Activities**

- Board Member - Raptor Research Foundation 2007-present.
- Associate Editor - Journal of Raptor Research 2001 - 2006.
- Associate Editor - Journal of Wildlife Management 2002 - 2004.

### **Professional Affiliations**

- Cooper Ornithological Society
- Raptor Research Foundation
- Society for the Conservation and Study of Caribbean Birds
- Society of Field Ornithologists
- Society of Southwestern Naturalists
- The Wildlife Society
- The Wildlife Society - Texas Chapter
- Wilson Ornithological Society

### **Selected Publications**

- Boal, C.W., C.L. Haralson, and W.H. Howe. 2008. Status of Golden Eagles in the Texas panhandle. *Journal of Raptor Research* 42:220-224.
- Boal, C.W. 2008. Observations of an Antillean Crested Hummingbird attacking saddled anoles. *Caribbean Journal of Ornithology* 21:48-49.
- Mannan, R.W., R.S. Steidl, and C.W. Boal. 2008. Identifying habitat sinks: a case study of Cooper's hawks in an urban environment. *Urban Ecosystems* 11:141-148.
- Boal, C.W. and T.S. Estabrook. 2007. Occurrence and condition of migrating Swainson's thrushes in the British Virgin Islands. *Wilson Journal of Ornithology* 119:716-720.
- Giovanni, M.D., C.W. Boal, and H.A. Whitlaw. 2007. Prey use and provisioning rates of breeding ferruginous and Swainson's hawks on the southern Great Plains. *Wilson Journal of Ornithology* 119:558-569.
- Merriman, J.W., C.W. Boal, T.L. Bashore, P.J. Zwank, and D.B. Wester. 2007. Abundance of diurnal raptors in relation to prairie dog colonies: implications for bird aircraft strike hazard. *Journal of Wildlife Management* 71:811-815.
- Boal, C.W., D.E. Andersen, P.L. Kennedy, and A. Roberson. 2006. Northern goshawk (*Accipiter gentilis*) ecology in the Western Great Lakes Region. *Studies in Avian Biology* 31:128-136.

## **Dr. Kevin Bronson**

### **Education**

- Ph.D. Auburn University. 1989. Major: Soil Fertility.
- M.S. University of the Philippines at Los Banos. 1984. Major: Soil Fertility. Minor: Agricultural Economics
- B.S. University of Maryland. 1981. Major: Soil Science.

### **Professional Experience**

- Associate Professor. Texas Tech University. 2003.
- Associate Professor. Texas A&M University. 2002-present.
- Chair. Cotton Precision Agric. Project. Texas A&M University. 2001-present.
- Assistant Professor. Texas A&M University. 1998-02.
- Adjunct Associate Professor. West Texas A&M University. 2002-present.
- Adjunct Assistant Professor. Texas A&M University. 1998-present.
- Affiliate Scientist. International Rice Research Institute. Manila, Philippines. 1995-98.
- Affiliate Assistant Professor. University of Philippines. 1995-99.
- Soil Chemist. Commonwealth Scientific and Industrial Research. Australia. 1994- 95.
- Associate Visiting Scientist. International Rice Research Institute. Manila, Philippines. 1992-94.
- Soil Scientist. USDA-ARS, Ft. Collins, CO. 1989-92.
- Faculty Affiliate. Colorado State University. 1989-92.
- Graduate Research Assistant. Auburn University. Auburn, Alabama. 1987-89.
- Soils Specialist. Soil and Water Division. Raleigh, NC. 1984-86.
- Biological Aide. National Agricultural Research Center. Beltsville, MD. 1980-81.
- Laboratory Assistant. West Virginia Soil Testing Laboratory. 1979-80.

### **Professional and Honorary Societies**

- American Society of Agronomy
- Soil Science Society of America
- Soil and Water Conservation Society
- Gamma Sigma Delta
- Sigma Xi

### **Honors and Awards**

- Dean's List. University of West Virginia. 1979.
- A. L. Smith Outstanding Graduate Student of the Year Award. Auburn University. 1998.
- Certification of Merit for Outstanding Performance. USDA-ARS. 1990.
- Editors Citation for Excellence in Manuscript Review. Soil Science Society of America. 2001.

### **Principal Research Interests**

- Soil fertility.

### **Selected Publications**

- Wheeler, T. A. and K. F. Bronson. 2004. Precision Agriculture: Tools of the Trade. Nemat. Mono & Perspect. 2:5-12.
- Bronson, K. F., C. L. Trostle, A. M. Schubert, and J. D. Booker. 2004. Leaf nutrients and yields of irrigated peanut in the Southern Plains: Influence of nitrogen, phosphorus and zinc fertilizer. Commun. Soil Sci. Plant Anal. 35 (7/8):1095-1110.
- Ping, J., C. J. Green, R. E Zartman, and K. F. Bronson. 2004. Exploring spatial dependence of cotton yield using global and local autocorrelation statistics. Field Crops. Res. 89:219-236.
- 7 -Bronson, K. F., T. M. Zobeck, T. T. Chua, R. S. Van Pelt, and V. Acosta-Martinez. 2004. Carbon and nitrogen pools of Southern High Plains grassland and cultivated soils. Soil Sci. Soc. Am. J. 68:1695-1704.
- Ping, J., C. J. Green, K. F. Bronson, R. E Zartman, and A. Dobermann. 2004. Identification of Relationships between Cotton Yield, Quality and Soil Properties. Agron. J. 96:1588-1597.



## **Dr. Perry Carter**

### **Education**

- Ph.D., Geography, Ohio State University, 1998
- M.A., Political Economy, University of Texas at Dallas, 1992
- M.A., Geography, University of Georgia, 1986
- A.B., Geography, University of Georgia, 1983

### **Professional Experience**

- Spring 2004, I developed and taught an upper-level undergraduate course in "Social and Cultural Geography." I was the first faculty member in my department to teach the newly developed capstone course "Seminar in Geography"
- Fall 2003, I developed and taught an upper-level undergraduate course in "Economic Geography"
- Spring 2003, I developed and have twice taught an upper-level undergraduate course entitled "Introduction to Research in Human Geography"
- Summer-Fall 2001-4, Over the past six semesters I have taught seventeen sections of "World Regional Geography"
- Fall 2002, I developed and have twice taught an upper-level undergraduate course in "Urban Geography"
- Spring 2000, I developed and taught a graduate seminar entitled "Geographies of Consumption," University of Kentucky
- 1995-1996, I have assisted in teaching four quarters of "Applications of Quantitative Methods in Geography I and II," The Ohio State University

### **Research Interests**

- General interests include human, social, urban and economic geography. Specific interests include geographies of consumption, travel and tourism, space and its role in the construction of racial identity, geographic methodologies.

### **Courses Offered**

- GEOG 2351: Regional Geography of the World
- GEOG 3351: Urban Geography
- GEOG xxxx: Human Geography
- GEOG xxxx: Geographic Methods

### **Selected Publications**

- "Geography, Race, and Quantification" (The Professional Geographer, 61(3) 2009)
- "Imagining Plantations: Slavery, Dominant Narratives, and the Foreign Born" with David Butler and Owen Dwyer (Southeastern Geographer, 48(3) 2008)
- "Women's Work: The Home, the Workplace, and the Spaces Between" with David Butler (The Industrial Geographer, 5(2) 2008)
- "Colored Places and Pigmented Holidays: Racialized Leisure Travel" (Tourism Geographies, 10(3), August 2008)
- "Penumbral Spaces: Undecidable bodies and Mobile Identities in Nella Larsen's Passing," (Gender, Place, and Culture, 13(3), June 2006)
- "The Entwined Spaces of 'Race', Sex and Gender" with Tobie Saad (Gender, Place, and Culture 12(1), March 2005)
- "The Travails of the Independent African-American Travel Agent," with David Butler and Stan Brunn (The Annals of Tourism Research, 29(4), 2002)

## **Dr. Ted Cleveland**

### **Education**

- Ph.D. University of California, Los Angeles, 1989, Civil Engineering
- M.S. University of California, Los Angeles, 1987, Civil Engineering
- B.S. Humboldt State University, 1986, Environmental Resources Engineering

### **Professional Experience**

- Associate Professor, TTU, August 1996
- Assistant Professor, TTU, August 1990
- Hydrogeologist, CH2M-Hill, Emeryville, CA, 1989-1990

### **Professional Service in Last Five Years**

- Faculty Advisor, Student Chapter, American Society of Civil Engineers 1990-1994; 2006-present
- Proposal Review Panel Member, USEPA/SBIR Program, Stormwater and Arsenic -Removal Technologies. 2002. Washington, D.C.
- Proposal Review Panel Member, USDA/SBIR Program, Industrial Applications of Agricultural Products. 1998-present. Washington, D.C.
- Advisory Trustee, Galveston Bay Foundation, 1992-present
- Environmental Institute of Houston, Advisory Board Member, 1996 - present
- Houston Teachers Institute, Advisory Board Member, 2006 – present

### **Selected Publications**

- Cleveland, T.G., and A. Fashokun, 2006."Construction-Associated Solids Loads with a Temporary Sediment Control BMP." American Society of Civil Engineers, Journal of Construction Engineering and Management, Vol 132., No. 10, pp
- Cleveland, T.G., X. He, W.H. Asquith, X. Fang, and D.B. Thompson, 2006. "Instantaneous Unit Hydrograph Selection for Rainfall-Runoff Modeling of Small Watersheds in North and South Central Texas." American Society of Civil Engineers, Journal of Irrigation and Drainage Engineering, Vol. 132, No. 5, pp.
- Asquith, W.H., Roussel, M.C., Cleveland, T.G., Fang, Xing, and Thompson, D.B., 2006. Statistical characteristics of storm interevent time, depth, and duration for eastern New Mexico, Oklahoma, and Texas. U.S. Geological Survey Professional paper 1725, 299p.
- Cleveland, T.G., He, X., Fang, X., Thompson, D.B. 2006. "Instantaneous Unit Hydrographs for Small Watersheds in Texas using Digital Elevation Data and Particle Tracking" in Costal Hydrology and Processes, Singh, V.P., and Xu, Y.J. eds. Water Resources Publications, Highlands Ranch, CO. pp 3-14
- Cleveland, T.G., He, X., Fang, X., Thompson, D.B. 2006. "Regressions Relating Watershed Physical Characteristics to Unit Hydrograph Parameters for Rainfall-Runoff Modeling in Central Texas" Costal Hydrology and Processes, Singh, V.P., and Xu, Y.J. eds. Water Resources Publications, Highlands Ranch, CO. pp 465-478.
- Fang, X., Pradhan, P., Malla, R., Cleveland, T.G., and Thompson, D.B. 2006. "Estimating Time of Concentration for Texas Watersheds" in Costal Hydrology and Processes, Singh, V.P., and Xu, Y.J. eds. Water Resources Publications, Highlands Ranch, CO. pp 465-478.
- Williams-Sether, T., Asquith, W.H., Thompson, D.B., Cleveland, T.G., and X. Fang. 2004. Empirical, Dimensionless, Cumulative-Rainfall Hyetographs for Texas. U.S. Geological Survey Scientific Investigations Report 2004-5075, 138p.
- Asquith, W.H. Thomson, D.B., Cleveland, T.G., and X. Fang. 2004. Synthesis of Rainfall and Runoff Data Used for Texas Department of Transportation Research Projects 0-4193 and 0-4194. U.S. Geological Survey Open-File Report 2004-103, 50p
- Cleveland, T.G. and M. Smith. 2003. "Demonstration of Remote Wireless Access to a Database for Communicating Water Quality Data." Final Report. Environmental Health Division, Houston Department of Health and Human Services.
- Cleveland, T.G., Thompson, D., Fang, X. 2003. Instantaneous Unit Hydrographs for Central Texas. Proceedings of Texas Section Spring 2003 Meeting, Corpus Christi, Texas.

## **Dr. Robert D. Cox**

### **Education**

- Sep 2006 Ph.D., Botany (Ecology and Conservation Biology) University of California—Riverside, CA. Dissertation: Ecology and Management of Rare Plants Following Exotic Invasions in Riverside County, California.
- Aug 2000 MS., Botany Brigham Young University—Provo, UT. Thesis: Experimental seeding of native species into crested wheatgrass and cheatgrass monocultures in Tooele County, Utah.
- Dec 1997 BS., Conservation Biology (Emphasis in Zoology) Brigham Young University—Provo, UT

### **Professional Experience**

- 2008-pres Assistant Professor, Habitat Restoration Ecology, Department of Natural Resources Management, Texas Tech University
- 2006- 2008 Post-doctoral Ecologist, Shrubland Ecology and Restoration Group, USDA Forest Service Rocky Mountain Research Station, Boise Lab
- 2003- 2007 Research Assistant, Center for Conservation Biology University of California Riverside
- 2003-2004 Teaching Assistant, Dept of Botany and Plant Science University of California Riverside
- 2002-2003 Teaching Assistant, Dept of Botany and Plant Science University Of California Riverside
- 2002 Associate Faculty, Dept of Biological Science Mt. San Jacinto Community College
- 1999-2000 Field Ecology Class Teaching Assistant, Dept of Botany and Range Science, Brigham Young University
- 1998-2000 Range Plant Ecology and Identification Class Teaching Assistant, Dept of Botany and Range Science, Brigham Young University
- 1998-2000 Plant Identification Team Coach, Dept of Botany and Range Science, Brigham Young University
- 1997-2000 Summer Ecology Technician, Directorate of Environmental Programs Dugway Proving Grounds
- 1994-1998 Student Office Clerk, Scholarship Department Brigham Young University

### **Research Interests**

- I am interested in community and restoration ecology, distribution and conservation of rare and endemic plant species, and ecology of invasive species. In research, I have focused on large-scale restoration experiments with practical applications. I've also researched landscape-scale factors contributing to the decline and loss of native plant communities and rare, endemic species.

### **Selected Publications**

- Cox, R.D. and E.B. Allen. 2008. Stability of exotic annual grasses following restoration efforts in southern California coastal sage scrub. *Journal of Applied Ecology* 45:495-504.
- Cox, R.D. and E.B. Allen. Composition of soil seed banks in southern California coastal sage scrub and adjacent exotic grassland. *Plant Ecology* ("online first" publication DOI 10.1007/s11258-007-9383-9).
- Allen, E.B., R.D. Cox, T. Tennant, S.N. Kee, and D. Deutsman. 2005. Landscape restoration in southern California forblands: Response of abandoned farmland to invasive annual grass control. *Israel Journal of Plant Science* 53:237-245.
- Cox, R.D., and V.J. Anderson. 2004. Increasing native diversity of cheatgrass-dominated rangeland through assisted succession. *J. Range Manage.* 57:203-210.

**Dr. Tina Delahunty****Education**

- Ph.D., Geography, University of Florida, 2002
- M.A., Geography, Florida Atlantic University, 1998
- B.S., Natural Resource Planning, Humboldt State University, 1995

**Professional Experience**

- 2005-present Assistant Professor - Dept. of Economics and Geography, TTU
- 2004-2005 Visiting Professor - Dept. of Economics and Geography, TTU
- 2003-2004 Geographer in Residence - Human Studies Division
- College of the Atlantic, Bar Harbor, ME
- 2000-2002 Adjunct Faculty - Dept. of Geography and Geology
- Florida Atlantic University, Boca Raton, FL
- 2002 Faculty – Broward Community College, FL
- 2000-2002 Faculty – Palm Beach Community College, FL

**Research Interests**

- Landuse Change. Remote Sensing. Biogeography. Paleoecology. Phytogeography.

**Courses Offered**

- GEOG 1401: Physical Geography
- GEOG 2351: World Regional Geography
- GEOG 3301/5301: Remote Sensing of the Environment
- GEOG 3310: Environmental Change
- GEOG 4321: Biogeography

**Publications**

- Submitted. Roberts, Charles, and Delahunty, J.L. "Textural Classification of Historical Landsat Imagery: A model for large urban areas." American Society for Photogrammetry and Remote Sensing (ASPRS).
- Submitted. Roberts, Charles, and Delahunty, J.L.. "A Technique for Creating Animated Maps of Urbanized Areas Using Landsat Imagery." Applied Geography.
- Revised and resubmitted. Delahunty, J.L., and Phelps, Jack. "Landcover change and remote sensing in the classroom: An exercise to study urban growth." Journal of Geography. Manuscript ID: RJOG-2009-0020. Second author: Jack Phelps, Undergraduate student, TTU
- 2009. Delahunty, J.L., Roberts, Charles, and Breary, Gillian. "ARVIDA and the Planned Sprawl of West Boca" The Florida Geographer. 40: 101-118.
- 2009. Delahunty, J.L.. "Yew Tree Toponyms and their Connection to the Irish Landscape." The American Geographical Society's Focus on Geography. 51(4): 1-6.
- 2009. Delahunty, Tina. "The Yew in Ireland." The Journal of the Irish Woodturners' Guild. 48(March): 22-24.
- 2007. Delahunty, J.L.. "The Ethnobotanical History and Holocene Extent of Yew (*Taxus baccata* L.) on the Irish Landscape. Journal of Ethnobiology. 27(2): 204-217.
- 2007. Delahunty, J.L., and Todd, Reese. "Cultivating Geography in Primary Schools." Association of American Geographers Newsletter. 42(8):13.
- 2007. Todd, Reese, and Delahunty, J.L.. " 'A' is for Aerial Maps and Art." Social Studies and the Young Learner. 20(2):11-14.
- 2007. Delahunty, Tina. "Exploring the landscape with second graders: Resources for Texas elementary school teachers." <<http://www.depts.ttu.edu/exploringlandscapes/index.asp>>.
- 2006. Todd, Reese, and Delahunty, J.L.. "Aerial Imagery and Geography Literacy." Texas Alliance for Geographic Education. 2006-2007: 6-7.
- 2005. Delahunty, J.L.. "Remote sensing as a tool for mapping and monitoring habitat: A case study of the St. Vincent Parrot (*Amazona guildingii*)." Caribbean Geography. 14(1):31-39.

**Dr. Clifford B. Fedler****Education**

- B.S. Agricultural Engineering, Iowa State University, 1979
- M.S. Agricultural Engineering, Iowa State University, 1981
- M.S. Civil Engineering, Iowa State University, 1981
- Ph.D. Agricultural Engineering, University of Illinois, 1985

### **Professional Experience**

- Assistant Professor (1985-1990), TTU
- Associate Professor (1990-1991), TTU
- Associate Chair (1990-1991), TTU
- Associate Professor (1991-1997), TTU
- Professor (1997-present), TTU
- Research Assistant, Iowa State University (1979-1981)
- Lab Assistant, Iowa State University (1980-1981)
- Research Assistant, University of Illinois (1981-1985)

### **Scientific and professional societies of which a member**

- American Society of Civil Engineers
- American Society of Agricultural Engineers
- American Society for Engineering Education
- World Aquaculture Society
- International Society for Epistecybernetics
- Water Environment Association of Texas
- Waste Environment Federation

### **Honors and awards**

- TTU Dads and Moms Association Spencer A. Wells Faculty Award for Creative Teaching (1998);
- Engineer of the Year Award awarded by the Texas Section of the American Society of Agricultural Engineers (1997);
- Top Paper Award, Gulf/Southwest Regional Conference of the ASEE (1992);
- Halliburton Outstanding Teaching Award, College of Engineering, Texas Tech University (1990);
- Outstanding Professor of the Year Award, ASEE Student Branch, Texas Tech University (1990,1992);
- Recipient of two 1988 ASAE Top Paper Awards (annual award presented to authors of the top 2.5 percent of the published papers);
- Halliburton Outstanding Researcher Award, College of Engineering, Texas Tech University (1986);
- Outstanding Teacher, University of Illinois, (1981-1983).

### **Selected Publications**

- Fedler, C.B. 2005. Recycling Water Saves Future Drinking Supplies. Vol. 46(2):50-56. BioCycle-Journal of Composting and Organics Recycling. The JG Press, Inc. Emmaus, PS 18049.
- Fedler, C.B., C.J. Green, B. Mueller, and P.R. Pearson. 2004. Denitrification for Land Applied Treated Wastewater. 12th Annual Texas On-Site Wastewater Treatment Research Council Conference. Pps. 273-287. March 2-3, 2004. Texas Natural Resource Conservation Commission. Austin, TX.
- Fedler, C.B. 2003. Improving Nitrogen Removal in Treatment Wetlands for Animal Waste Treatment. U.S. Department of Agriculture Natural Resources Conservation Service East Regional Technology Workshop. Syracuse, NY, 17-19 June 2003.

## **Dr. Ernest B. Fish**

### **Education**

- B.S. Forest-Range Management, Colorado State University, 1964
- M.S. Range Ecology/Statistics, Colorado State University, 1966
- Ph.D. Watershed Management/Statistics, University of Arizona, 1973

### **Professional Experience**

- Laborer, U. S. Forest Service, Coconino National Forest, 1960
- Range Research Aide, State of Colorado, 1961
- Range Aide and Technician, U. S. Forest Service, 1963-4
- Range Conservationist, Soil Conservation Service, 1965
- Range Conservationist, Soil Conservation Service, 1966
- Graduate Teaching Assistant, Colorado State University, 1965-6
- Instructor, Colorado State University, 1966
- Instructor, University of Arizona, 1968-73
- Assistant Professor, Texas Tech University, 1973-7
- Associate Professor, Texas Tech University, 1977-81
- Interim Chairman, Texas Tech University, 1977-8
- Interim Assistant Dean, Texas Tech University, 1978-9
- Interim Chairman, Texas Tech University, 1982-3
- Ecologist, National Park Service, Anchorage, Alaska, 1985-6
- Interim Academic Coordinator, Texas Tech University, 1989-90
- Interim Chairman, Texas Tech University, 1997
- Associate Chairman, Texas Tech University, 1998-9
- Chairman, Texas Tech University, 1999-2008
- Professor, Texas Tech University, 1981-Pres.

### **Research Interests**

- “My students and I are currently involved in interdisciplinary research programs encompassing environmental inventories, geographic information systems applications, land use analysis, and land management planning in the southwestern region of the United States. Much of this work is conducted in my role as Director of the Geospatial Technologies Laboratory.”

### **Courses Taught**

- NRM 3308, 4314, 4315, 4403, 5317, 5404, 6303, 6305

### **Service**

- Currently serves as the Director of the Geospatial Technologies Lab.

### **Selected Publications**

- Brenton, C. M., E. B. Fish, and R. Mata-Gonzalez. 2007. Macronutrient and trace element leaching following biosolids application on semiarid rangeland soils. *Arid Land Research and Management* 21(2):143-156.
- Rice, M. B., W. B. Ballard, E. B. Fish, D. B. Wester, and D. Holdermann. 2007. Landowner attitudes toward black bears in the Trans-Pecos Region of Texas. *Human Dimensions of Wildlife* 12:405-415.
- Jurado, P., D. B. Wester, and E. B. Fish. 2006. Soil nitrate-nitrogen dynamics after biosolids application in a tobosagrass desert grassland. *Journal of Environmental Quality* 35:641-650.
- Hall, D. L., M. R. Willig, D. L. Moorhead, R. W. Sites, E. B. Fish, and T. R. Mollhagen. 2004. Aquatic macroinvertebrate diversity of playa wetlands: the role of landscape and island biogeographic characteristics. *Wetlands* 24(1):77-91.
- Arzani, H., M. Zohdi, E. Fish, G. H. Zahedi Amiri, A. Nikkhah, and D. Wester. 2004. Phenological effects on forage quality of five grass species. *Journal of Range Management* 57(6):624-629.
- Kamler, J. F., W. B. Ballard, E. B. Fish, P. R. Lemons, K. Mote, and C. C. Perchellet. 2003. Habitat use, home ranges, and survival of swift foxes in a fragmented landscape: conservation implications. *Journal of Mammalogy* 84(3):989-995.

## **Dr. Jeff Johnson**

### **Education**

- 2003 Ph.D. Agricultural Economics Texas Tech University
- 2002 Master of Strategic Studies U.S. Army War College
- 1981 Master of Agriculture Agricultural Economics Texas A&M University
- 1975 Bachelor of Science Animal Science Texas A&M University

### **Professional Experience**

- Sept 2005 – present
  - Assistant Professor, Department of Agricultural and Applied Economics, Texas Tech University (50% appointment)
  - Assistant Professor, Agricultural Economics, Texas AgriLife Research - Lubbock, (25% appointment).
  - Managing Director, Farm Operations, Texas Tech University (25% appointment).
- April 1994 – Aug 2005 Managing Director, Farm Operations, Texas Tech University.
- July 1992 – Mar 1994 Farm Management Associate – Texas Agricultural Extension Service – Weslaco.
- July 1990 – July 1992 Owner – Agricultural Management Information Services
- Oct 1984 – July 1990 Program Coordinator – Stiles Farm Foundation – Texas Agricultural Extension Service
- June 1981 – Oct 1984 Financial Analyst – Petty Ranch Company – San Antonio, Texas

### **Teaching**

- Farm and Ranch Management (junior level), Applied Optimization Methods (senior level) and
- Environmental Economics and Policy Analysis (graduate level distance ).
- Served as committee chairman or co-chairman for 3 PhD and 4 MS students.
- Served as committee member on 14 other graduate committees, 10 of which were Crop Science students.
- Served as advisor for 4 undergraduate research projects.

### **Research Interests**

- Regional Policy Alternatives in Response to Depletion of the Ogallala Aquifer  
Adoption and implementation of effective water conservation policies can extend the life of the Ogallala Aquifer in the Southern High Plains of Texas. The primary objective of this study is to analyze the impact of water conservation policy alternatives on the regional economy of the Southern High Plains of Texas.
- Integrated Cotton Production Systems for Optimizing Profitability in the TSHP  
Recent technology advances for cotton production in areas of improved cultivars, irrigation technology advances, and pest management strategies have required changes in production practices. The primary objective of this study is to evaluate the farm level economic impacts associated with the widespread adoption of production approaches relating to cultivar selection, water and nutrient levels, irrigation technology, and pest management strategies.

### **Selected Publications**

- Dudensing, J., J. Johnson, P. Johnson, and C. Villalobos. Grazing Alternatives in the Face of Declining Groundwater: A Case from the Southern High Plains of Texas. *Texas Journal of Agriculture and Natural Resources*. 2009.
- Johnson, J., P.N. Johnson, E. Segarra, and D. Willis. Water Conservation Policy Alternatives for the Ogallala Aquifer in Texas. *Water Policy* 11(2009) 537-552.
- Wheeler, E., B. Golden, J. Johnson, and J. Peterson. Economic Efficiency of Short-term Versus Long-term Water Rights Buyouts. *Journal of Agricultural and Applied Economics* ( Volume 40, Number 2) 2008.
- Wheeler-Cook, E., E. Segarra, P. Johnson, J. Johnson, and D. Willis. Water Conservation Analysis: The Case of the Southern Ogallala Aquifer. *Texas Journal of Agriculture and Natural Resources*. 2009.
- Wilde, C., J. Johnson, and J. Bordovsky. Economic Analysis of Subsurface Drip Irrigation System Uniformity. *Applied Engineering in Agriculture*. In press.

## **Dr. Robert Lascano**

### **Education**

- Ph.D. Texas A&M University. 1982.
- M.S. Texas A&M University. 1977.
- B.S. Texas A&M University. 1974.

### **Professional Experience**

- USDA-Agricultural Research Service: Physical Scientist – Southern Plains Area

-Research Leader: WEWC-Soil Physicist

### **Projects**

- Soil Management for Sustainable Agricultural Systems That Prevent Wind Erosion and Enhance the Environment
- Managing Limited Irrigation and Rainfall for Crop Production in Semi-Arid Environments
- Sustaining Rural Economies Through New Water Management Technologies
- Big Spring - Federal Bureau of Prisons Support of Mutual Interest
- Deficit Irrigation Management to Conserve Ogallala Aquifer Water
- New Water Management Technologies to Sustain Rural Economies - TTU
- Managing Soil and Cropping Systems for Efficient Water Use
- New Water Management Technologies to Sustain Rural Economies - TAMU
- New Water Management Technologies to Sustain Rural Economies - WTAMU
- Deficit Irrigation Management to Conserve Ogallala Aquifer Water

### **Selected Publications**

- Baker, J.T., Van Pelt, R.S., Gitz, D.C., Payton, P.R., Lascano, R.J., McMichael, B.L. 2009. Canopy gas exchange measurements of cotton in an open system. *Agronomy Journal*. 101(1):52-59.
- Lascano, R.J., Evett, S.R., Van Bavel, C. 2008. Evapotranspiration: Measured with a lysimeter vs. calculated with a recursive method[abstract]. American Society of Agronomy, Crop Science Society of America, Soil Science Society of America Joint Annual Meeting. October 5-9, 2008. Houston, Texas. Paper No. 703-2.
- Baker, J.T., Lascano, R.J., Gitz, D.C., Payton, P.R., Van Pelt, R.S., Garcia, R. 2008. An open system for measuring canopy gas exchange[abstract]. ASA-CSSA-SSSA Joint Annual Meeting. Houston, Texas. October 5-9, 2008. Abstract No. 779-4.
- Bufon, V., Lascano, R.J. 2008. Hydrus-3D simulations: Irrigation management strategies for the Texas High Plains[abstract]. American Society of Agronomy, Crop Science Society of America, Soil Science Society of America Joint Annual Meeting. October 5-9, 2008. Houston, Texas. Paper No. 534-12.
- Nelson, R., Lascano, R.J., Booker, J. 2008. Circular planting patterns in dryland crops: Surface hydrology[abstract]. American Society of Agronomy, Crop Science Society of America, Soil Science Society of America Joint Annual Meeting. October 5-9, 2008. Houston, Texas. Paper No. 755-4.
- Pelletier, M.G., Schwartz, R.C., Evett, S.R., McMichael, B.L., Lascano, R.J., Gitz, D.C., Baker, J.T., Payton, P.R. 2008. Analysis of Coaxial Soil Cell. In: *Agronomy Society of America, Crop Science Society of America, Soil Science Society of America Meeting*, Oct. 6-8, 2008, Houston, TX. 2008 CDROM.
- Evett, S.R., Howell, T.A., Lascano, R.J., Tolk, J.A. 2008. Two- and one-layer implicit energy balance solutions compared with the one-layer explicit Penman-Monteith solution for evapotranspiration of alfalfa [abstract]. 2008 Joint Meeting of American Society of Agronomy, Soil Science Society of America, and Crop Science Society of America, October 5-9, 2008, Houston, Texas. Paper No.703-3. 2008 CDROM.



## **Dr. Colleen Ann Leary**

### **Education**

- B.S. Massachusetts Institute of Technology, 1970
- M.S. Massachusetts Institute of Technology, 1973
- Ph.D. University of Washington, 1978

### **Professional Experience**

- Professor, Atmospheric Science, Texas Tech University, 1989-present
- Associate Professor, Atmospheric Science, Texas Tech University, 1983-1989
- Assistant Professor, Atmospheric Science, Texas Tech University, 1978-1983
- Meteorologist, Environmental Research and Technology, Inc., Lexington, MA, 1972-1974

### **Graduate Courses**

- ATMO 5302 Weather, Climate, and Applications (for M.S. program in Interdisciplinary Science Teaching)
- ATMO 5320 Mesometeorology
- ATMO 5327 Radar Meteorology
- ATMO 5328 Synoptic Meteorology
- G PH 5310 Geophysical Fluid Mechanics

### **Other Departmental Activities**

- Undergraduate advisor for students with a minor in Atmospheric Science

### **Recent Publications**

- Teacher's manual for the 2nd edition of the current textbook *Meteorology* by Ackerman and Knox, published by Thompson Publishing Company, 2006. The teacher's manual is available and distributed by the publisher on-line.
- Leary, Colleen A., 2002: Clouds: Cumuliform, in Encyclopedia of Atmospheric Sciences, edited by Holton, Pyle, and Curry, 2002. Academic Press. This article was invited and peer-reviewed.

### **Current Participation in Professional Organizations**

- American Meteorological Society, American Geophysical Union

### **Other Professional Activities**

#### **Reviews for Government Agencies**

- Reviewed proposals by mail for the National Science Foundation
- Reviewed proposals for the ARM program of the U.S. Department of Energy
- Reviewed for the American Meteorological Society journal *Monthly Weather Review*
- In the spring of 2005 and 2007, participated in panel reviews at the National Science Foundation

#### **Current Research Interests**

- Boundary layer meteorology, radar meteorology, tropical mesoscale convective systems, shipborne Doppler weather radar observations, gravity waves

### **Awards**

- American Meteorological Society, Editor's award for review of manuscripts, *Monthly Weather Review*, 2002.

**Dr. Jeff Lee****Education**

- Ph.D., Geography, Arizona State University, 1990.
- M.A., Geography, University of California, Los Angeles, 1984.
- B.A., Geography, University of California, Los Angeles, 1979.

**Professional Experience**

2009- Professor, Department of Economics & Geography, Texas Tech University

1994-09 Associate Professor, Dept. of Economics & Geography, Texas Tech University

1988-94 Assistant Professor, Dept. of Geography, Texas Tech University

1988 Instructor, Department of Earth Science, Palomar College  
1987 Lecturer, Department of Geography, San Diego State University

1985-87 Research Associate, Arizona State University Planetary Geology Group

1984-85 Instructor, Department of Geography, Arizona State University

1984 Research Associate, Arizona Laboratory of Climatology

**Research Interests**

- Physical geography. Geomorphology. Arid Lands. Field methods. Aeolian processes, especially wind erosion as a natural process and human influences on wind erosion.
- Science education.

**Courses Offered**

- GEOG 1401: Physical Geography
- GEOG 3335: Field Seminar in Physical Geography
- GEOG 3310: Environmental Change
- GEOG 4301: Geomorphology in Environmental Management
- GEOG 5304: Advanced Physical Geography
- HONS 2305: Honors Seminar in Science
- I S 5301: The Nature of Science for Teachers

**Professional Service**

- Treasurer of the International Society of Aeolian Research
- Started and moderated GEOMORPHLIST, an e-mail distribution service, for the International Association of Geomorphologists, 1993-1999.
- Secretary/Treasurer and then President of the Geomorphology Specialty Group of the Association of American Geographers from 1997 to 1999.
- Co-organizer of ICAR5/GCTE-SEN Joint Conference (International Wind Erosion Conference), Texas Tech University, July 2002.
- Served as advisor for Multidisciplinary Science Masters Program, 2000-2006
- Advisor for the undergraduate Interdisciplinary Minor in Geographic Information Science
- Advisor for the "Environmental Evaluation" Interdisciplinary Master's Program

**Selected Publications**

- Lee, Jeffrey A., 2005, George Perkins Marsh; *Focus on Geography*, v.48, no. 3, p. 35-6.
- Lee, Jeffrey A., 2004, Explaining the Plagues of Egypt, *Skeptical Inquirer*, v.28, no. 6, p. 52-4.
- Lee, Jeffrey A., 2004, Charles Darwin and Thomas Henry Huxley, *Focus on Geography*, v. 47, no. 4, p. 34-36.

- Stout, J. E. and Lee, J. A., 2003, Indirect Evidence of Wind Erosion Trends on the Southern High Plains of North America; *Journal of Arid Environments* v. 55, p. 43-61.
- Lee, J. A. and Zobeck,, Ted M., eds., 2002, *Proceedings of ICAR5/GCTE-SEN Joint Conference*, International Center for Arid and Semiarid Lands Studies, Texas Tech University, Lubbock, Texas, USA Publication 02-2, 462 p.
- Lee, Jeffrey A., 2002, Louis Agassiz, *Focus on Geography*, v. 47, no. 2, p. 30-31.

## **Dr. David Leverington**

### **Education**

- 1996-2001 Ph.D., Geological Sciences, Dept. of Geological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada.
- 1993-1995 M.Sc., Earth Science, Ottawa-Carleton Geoscience Centre, University of Ottawa, Ottawa, Ontario, Canada.
- 1988-1992 B.A. (Hon.), Physical Geography, (Magna Cum Laude), Department of Geography, University of Ottawa, Ottawa, Ontario, Canada.

### **Professional Experience**

- 2005-pres. Assistant Professor (tenure track), Department of Geosciences, Texas Tech University, Lubbock, Texas.
- 2001-2005. Postdoctoral Fellow, Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, Washington, DC.
- 2001-2001. Postdoctoral Fellow, Dept. of Geological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada.

### **Selected Publications**

- Leverington, D.W., (in press), Discrimination of sedimentary lithologies using Hyperion and Landsat TM data: A case study at Melville Island, Canadian High Arctic, International Journal of Remote Sensing.
- Leverington, D.W., 2009, Reconciling channel formation mechanisms with the nature of elevated outflow systems at Ophir and Aurorae Plana, Mars, Journal of Geophysical Research, 114: E10005, doi:10.1029/2009JE003398.
- Leverington, D.W., 2007, Was the Mangala Valles system incised by volcanic flows?, Journal of Geophysical Research, 112, E11005, doi:10.1029/2007JE002896.
- Thompson, T.W., Campbell, B.A., Ghent, R.R., Hawke, B.R., Leverington, D.W., 2006, Radar probing of planetary regoliths: An example from the northern rim of Imbrium Basin, Journal of Geophysical Research, 111: E06S14, doi:10.1029/2005JE002566.
- Leverington, D.W., 2006, Volcanic processes as alternative mechanisms of landform development at a candidate crater-lake site near Tyrrhena Patera, Mars, Journal of Geophysical Research, 111, E11002, doi:10.1029/2004JE002382.
- Duguay, C.R., Zhang, T., Leverington, D.W., Romanovsky, V.E., 2005, Satellite remote sensing of permafrost and seasonally frozen ground, In Remote Sensing in Northern Hydrology: Measuring Environmental Change (C.R. Duguay and A. Pietroniro, Eds), Geophysical Monograph 163, American Geophysical Union, pp.91-118.
- Leverington, D.W., Moon, W.M., 2005, On the use of consensus algorithms to address variability in the results of neural network classifications: Preliminary tests involving two northern study areas, Canadian Journal of Remote Sensing, 31: 269-273.
- Clarke, G.K.C., Leverington, D.W., Teller, J.T., Dyke, A.S., Marshall, S.J., 2005, Fresh arguments against the Shaw megaflood hypothesis - A reply to comments by David Sharpe, Correspondence, Quaternary Science Reviews, 24: 1533-1541.
- Ghent, R.R., Leverington, D.W., Campbell, B.A., Hawke, B.R., Campbell, D.B., 2005, Earth-based observations of radar-dark crater haloes on the Moon: Implications for regolith properties, Journal of Geophysical Research, 110: E02005, doi:10.1029/2004JE002366.
- Leverington, D.W., 2004. Volcanic rilles, streamlined islands, and the origin of outflow channels on Mars, Journal of Geophysical Research, 109: E10011, doi:10.1029/2004JE002311.
- Leverington, D.W., Maxwell, T.A., 2004. An igneous origin for features of a candidate crater-lake system in western Memnonia, Mars, Journal of Geophysical Research, 109: E06006, doi:10.1029/2004JE002237.

## **Dr. Stephen Maas**

### **Education**

- Ph.D. Texas A&M University. 1985. Agronomy.
- M.S. Texas A&M University. 1975. Meteorology.
- B.S. Texas A&M University. 1973. Meteorology.
- Temple Junior College. Temple, TX. 1969-70.

### **Professional Experience**

- Professor of Agricultural Microclimatology. Department of Plant and Soil Science. Texas Tech University. 2000 to present.
- Plant Physiologist. Agricultural Research Service. Western Integrated Cropping Systems Research Unit. U.S. Department of Agriculture. 1993-2000.
- Plant Physiologist. Agricultural Research Service. Remote Sensing Research Unit. U.S. Department of Agriculture. 1984-93.
- Graduate Teaching and Research Assistant. Department of Meteorology, Department of Soil & Crop Sciences. Texas A&M University. 1982-84.
- Meteorologist. Joint Appointment, Texas Agricultural Experiment Station and U.S. Department of Agriculture. 1980-81.
- Research Scientist. Blackland Research Center. Texas Agricultural Experiment Station. 1977-80.
- Senior Meteorologist. Meteorology Research, Inc. Altadena, California. 1975-77.
- Graduate Research Assistant. Department of Meteorology. Texas A&M University. 1973-74.
- Research Assistant. Blackland Research Center. Texas Agricultural Experiment Station. 1973.

### **Professional and Honorary Societies**

- American Society of Agronomy (ASA)
- American Society for Photogrammetry and Remote Sensing (ASPRS)

### **Principal Research Interests**

- Remote sensing, crop growth modeling, environmental factors affecting crop growth, precision agriculture, crop yield prediction.

### **Books and Book Chapters**

1. Maas, S. J. 2003. Irrigation scheduling by remote sensing technologies. In B. A. Stewart and T. A. Howell (Eds.), Encyclopedia of Water Science. Marcel Dekker, New York, NY. pp. 523-527.
2. Moran, M. S., S. Maas, V. Vandebilt, S. Miller, and E. Barnes. Natural resources and environment: Irrigated agriculture. In S. L. Ustin (Ed.), Manual of Remote Sensing, Vol. 5. John Wiley and Sons, New York, NY. pp. 617-676.

### **Selected Publications**

- Fitzgerald, G. J., S. J. Maas, and W. R. DeTar. 2004. Spider mite detection and canopy component mapping in cotton using hyperspectral imagery and spectral mixture analysis. J. Precision Agriculture. 5:279-289.
- Wanjura, D. F., S. J. Maas, D. R. Upchurch, and J. C. Winslow. 2004. Scanned and spot measured canopy temperatures of cotton and corn. Computers and Electronics in Agriculture. 44:33-48.
- Baez, A. D., J. Kiniry, S. J. Maas, M. Tiscereno, J. Macias, J. Mendoza, C. Richardson, J. Salinas G., and J. R. Manjarrez. 2005. Large-area maize yield forecasting using leaf area index based yield model. Agronomy Journal. 97(2):418-425.
- Ko, J., S. J. Maas, R. J. Lascano, and D. Wanjura. Modification of the GRAMI model for cotton. Agronomy Journal, accepted.
- Bronson, K. F., J. D. Booker, S. J. Officer, R. J. Lascano, S. J. Maas, S. W. Searcy, and J. Booker. 2005. Apparent electrical conductivity and soil properties in the Southern High Plains. J. of Precision Agric. 6:297-311.

(Full CV at <http://www.pssc.ttu.edu/personnel/smaas/MaasCV.pdf>)

## **Dr. Nancy E. MacIntyre**

### **Education**

- Ph.D. Ecology, Colorado State University, 1998
- M.S. Zoology, University of Georgia, 1993
- B.S. Zoology, University of Georgia, 1991

### **Professional Experience**

- 2006-Present: Associate Professor, Department of Biological Sciences, TTU
  - Curator of Birds, Natural Science Research Laboratory, The Museum of TTU
- 2005-Present: Environmental Consultant, Lubbock, TX
- 2000 – 2006: Assistant Professor, Department of Biological Sciences, TTU
- 1998 – 2000: Postdoctoral Research Associate, Central Arizona-Phoenix Long-Term Ecological Research Project, Arizona State University, Tempe, AZ
- 1997 – 1998: Graduate Writing Fellow, Colorado State University, Fort Collins, CO
- 1993 – 1997: Graduate Teaching Assistant, Department of Biology, Colorado State U.
- 1992 – 1993: Graduate Research Fellow, University of Georgia, Athens, GA
- 1992: Graduate Research Assistant, Savannah River Ecology Laboratory, Aiken, SC
- 1991 – 1992: Graduate Teaching Assistant, Department of Zoology, U. of Georgia
- 1990 – 1991: Laboratory worker, UGA Institute of Ecology Horseshoe Bend Program
- 1990: Intern, Museum of Natural History, University of Georgia, Athens, GA

### **Awards**

- 1998 NASA-Michigan State U. Professional Enhancement Award in Landscape Ecology
- 1997 University-wide Graduate School Dissertation Fellowship, Colorado State U.
- 1996 Graduate Degree Program in Ecology Teaching Fellowship, Colorado State U.
- 1996 Colorado Graduate Fellowship, Colorado State University
- 1995 Graduate Degree Program in Ecology Teaching Fellowship, Colorado State U.
- 1992 Graduate Teaching Assistant Merit Supplement, University of Georgia
- 1992 University-wide Graduate Assistantship, University of Georgia
- 1991 University of Georgia Department of Zoology Grace Thomas Award

### **Recent Courses Taught**

- Community Ecology / Advanced Community Ecology
- Ecology of Arid and Semi-arid Lands
- General Ornithology / Advanced Ornithology
- Landscape Ecology / Advanced Landscape Ecology
- Metapopulation Biology
- Ornithological Curation Techniques
- Principles of Ecology (formerly Populations, Communities, and Ecosystems)

### **Selected Publications**

- Bell, C.W., V.A. Martinez, N.E. McIntyre, S. Cox, D. Tissue, and J. Zak. 2009. Linking microbial community structure and function to seasonal differences in soil moisture and temperature in a Chihuahuan Desert grassland. *Microbial Ecology* 58:827-842. DOI: 10.1007/s00248-009-9529-5.
- Brunjes, K.J., W.B. Ballard, M.H. Humphrey, F. Harwell, N.E. McIntyre, P.R. Krausman, and M.C. Wallace. 2009. Home ranges of sympatric mule deer and white-tailed deer in Texas. *Southwestern Naturalist* 54:253-260.
- Holsomback, T.S., N.E. McIntyre, R.A. Nisbett, R.E. Strauss, Y.-K. Chu, A.A. Abuzeineh, N. de la Sancha, C.W. Dick, C.B. Jonsson, and B.E.L. Morris. 2009. Bayou virus detected in non-Oryzomyine rodent hosts: an assessment of habitat composition, reservoir community structure, and marsh rice rat social dynamics. *Journal of Vector Ecology* 34:9-21.
- McIntyre, N.E., R.A. Nisbett, A. Abuzeineh, T. Holsomback, Y.-K. Chu, J.A. Carmichael, N. de la Sancha, C.W. Dick, C.B. Jonsson, and R.D. Owen. 2009. Ecological correlates of serological status for Bayou virus in *Oryzomys palustris* (Rodentia: Sigmodontinae). *Mastozoología Neotropical* 16:83-93.
- Reece, B.A., and N.E. McIntyre. 2009. Community assemblage patterns of odonates inhabiting a wetland complex influenced by anthropogenic disturbance. *Insect Conservation and Diversity* 2:73-80. DOI: 10.1111/j.1752-4598.2008.00044.x.

## **Dr. Kevin Mulligan**

### **Education**

- Ph.D., Geography, Texas A&M University, 1997
- M.A., Geography, University of California, Los Angeles, 1985
- B.A., Geography, University of California, Los Angeles, 1979

### **Professional Experience**

- Director, Center for Geospatial Technology  
Texas Tech University, Lubbock Texas, 2005-present
- Associate Professor, Department of Economics and Geography,  
Texas Tech University, Lubbock, Texas, 2005- present
- Assistant Professor, Department of Economics and Geography,  
Texas Tech University, Lubbock, Texas, 1999- present
- Lecturer and Visiting Assistant Professor, Department of Geography,  
Texas A&M University, College Station, Texas, 1996-98.

### **Research Interests**

- Applied geospatial technologies (geographic information systems, remote sensing, GPS, geospatial database design, digital cartography, terrain visualization and Internet mapping).
- Arid and semi-arid environments. Desert geomorphology, hydrology and climate. Aeolian processes. Field research methods and instrumentation in physical geography.

### **Courses Offered**

- GEOG 1401: Physical Geography
- GEOG 3300/5300: Geographic Information Systems
- GEOG 3301/5301: Remote Sensing of the Environment
- GEOG 4302/5302: Advanced Geographic Information Systems

### **Selected Publications**

- Barbato, L. S. and Mulligan, K. R., 2004, Automating Texas' first and largest underground water district: a well permit management application and database. *Proceedings, Twenty-Fourth Annual ESRI International User Conference*, San Diego, California (CD-ROM).
- Mulligan, K. R. and Fish, E. B., 2004, Mapping Playa Lake Basins on the Llano Estacado, Texas, *GIS – The Language of Geography*, ESRI Map Book, vol. 19, p. 22.
- Mulligan, K. R., DeBaca, R. S., Barbato, L. S. and Speer, J. B., 2004, West Texas Atlas of Rural and Community Health. *GIS – The Language of Geography*, ESRI Map Book, vol. 19, p. 58.
- Nagihara, S., Mulligan, K. R., and Xiong, W., 2004, Use of a three-dimensional laser scanner to digitally capture the topography of sand dunes in high spatial resolution. *Earth Surface Processes and Landforms*, vol. 29, 391-398.
- Mulligan, K. R., 2003, Feasibility of using satellite imagery to aid in the assessment of tornado damage. *Final Report, Windstorm Mitigation Initiative Year 4, Research Thrust C: Windstorm Economics*, National Institute of Standards and Technology (NIST), 33 p.
- Barbato, L. S., Mulligan, K. R., and Weinbeck, S., 2003, Distribution of Historical Tornadoes 1950-1995, *Geography and GIS – Serving Our World*, ESRI Map Book vol. 18., p. 30.
- Mulligan, K. R., and Tchakerian, V. P., 2002, Toward a genetic classification of aeolian sand dunes. In *Proceedings of the ICAR5/GCTE-SEN Joint Meeting (Fifth International Conference on Aeolian Research)*, Lee, J. and Zobeck T.M. (eds.), International Center for Arid and Semiarid Lands Studies, Texas Tech University, Lubbock, Texas, Publication No. 02-2, p. 449.

## **Dr. Seiichi Nagihara**

### **Education**

- Ph.D. (Geological Sciences), University of Texas at Austin, 1992, Supervisors: John G. Sclater and Arthur E. Maxwell
- M.S. (Geophysics), Chiba University, Japan, 1987
- B.S. (Geophysics), Chiba University, Japan, 1985

### **Professional Experience**

- 7/87 - 5/92, Research Assistant, Institute for Geophysics, University of Texas at Austin
- 5/92 - 6/92, Post-doctoral Fellow, Institute for Geophysics, University of Texas at Austin
- 7/92 - 12/94, Postgraduate Research Geophysicist, Scripps Institution of Oceanography, University of California, San Diego
- 1/95 - 8/00, Research Assistant Professor, Department of Geosciences, University of Houston
- 1/99 - 8/00, Research Associate, Allied Geophysical Laboratory, University of Houston
- 9/00 - 8/06, Assistant Professor, Department of Geosciences, Texas Tech University
- 9/06 - present, Associate Professor (tenured), Department of Geosciences, Texas Tech University

### **Selected Publications**

- Nagihara, S. in press, Characterization of the sedimentary thermal regime along the Corsair growth fault zone, Texas continental shelf, using corrected bottom-hole temperatures: Amer. Assoc. Petrol. Geol. Bull.
- Nagihara, S., and M. A. Smith, 2008, Regional overview of deep sedimentary thermal gradients of the geopressured zone of the Texas-Louisiana continental shelf: Amer. Assoc. Petrol. Geol. Bull., v. 92, p. 1-14.
- Nagihara, S., and K. O. Jones, 2005, Geothermal heat flow in the northeast margin of the Gulf of Mexico: *American Association of Petroleum Geologists Bulletin*, v. 89, p. 821-831.
- Nagihara, S., and M. A. Smith, 2005, Geothermal gradient and temperature of hydrogen sulfide-bearing reservoirs in the continental shelf off Alabama: *American Association of Petroleum Geologists Bulletin*, v. 89, p. 1451-1458.
- Nagihara, S., K. R. Mulligan, and W. Xiong, 2004, Use of a three-dimensional laser scanner to digitally capture the topography of sand dunes in high spatial resolution: *Earth Surface Processes and Landforms*, v. 29, p. 391-398.



## **Dr. Ken Rainwater**

### **Education**

- B.S. Civil Engineering, Rice University, 1979
- M.S. Civil Engineering, (water resources), The University of Texas at Austin, 1982
- Ph.D. (water resources), The University of Texas at Austin, 1985

### **Professional Experience**

- Assistant Professor (1985-1991);
- Associate Professor (1991-2002);
- Joint Faculty, Department of Geosciences (1992-present); Professor (2002-present);
- Director, Texas Tech University Water Resources Center, (2002-present)

### **Professional societies**

- American Society of Civil Engineers
- American Geophysical Union
- Association of Ground Water Scientists and Engineers Delegate
- Universities Council on Water Resources
- Diplomate, American Academy of Environmental Engineers

### **Honors and awards**

- Ex-Students Association New Faculty Award, 1987
- Halliburton Education Foundation Research Award, 1987
- Tau Beta Pi Outstanding Professor Award, 1988
- Abell Faculty Teaching Award, College of Engineering, 1989, 2001
- President's Excellence in Teaching Award, 1990
- Zone III Faculty Advisor of the Year, American Society of Civil Engineers, 1996, 1998
- Texas Tech University Teaching Academy, 1996-
- Who's Who Among America's Teachers, 1998
- Department of Civil Engineering Teacher of the Year, 2000
- Service to Students Award, Texas Section, American Society of Civil Engineers, 2001
- Faculty Advisor Reward, American Society of Civil Engineers, 2001, 2002

### **Professional service in the last five years**

- Departmental committees* – ABET (chair), Scholarships (chair), Water resources faculty search (chair)
- College committees* – Awards, Scholarships, ABET, External departmental tenure and promotion review
- University committees* – Tenure hearing, Water initiative, Faculty book award
- Professional* – Co-faculty advisor ASCE student chapter, reviewer of manuscripts (NGWA [associate editor], AGU, Bioremediation) and proposals (NSF, USGS, EPA)

### **Selected Publications**

- Rainwater, K.A., Stovall, J.N., Frailey, S.M., and Urban, L.V., "Transboundary Impacts on Regional Groundwater Modeling in Texas," invited for special edition of *Ground Water*, NGWA, accepted, in press.
- Jackson, W.A., Anandam, S., Anderson, T., Lehman, T.M., Rainwater, K.A., Rajagopalan, S., Ridley, M., and Tock, W.R., 2005. "Occurrence of Perchlorate in the Texas Southern High Plains Aquifer System," *Ground Water Monitoring and Remediation*, NGWA, Vol. 25, no.2, pp. 137-149.
- Rainwater, K.A., Jackson, W.A., Ingram, W., Lee, C.Y., Thompson, D.B., Mollhagen, T.R., Ramsey, R.H., and Urban, L.V., 2005. "Field Demonstration of the Combined Effects of Absorption and Evapotranspiration on Septic System Drainfield Capacity," *Water Environment Research*, Vol. 77, no.2, pp. 150-161.
- Williams, D.L., Timmons, J.C., Woodyard, J.D., Rainwater, K.A., Lightfoot, J.M., Richardson, B.R., Burgess, C.E., and Heh, J.L., 2004. "UV-Induced Degradation Rates of 1,3,5 Triamino 2,4,6 Trinitrobenzene (TATB)," *Journal of Physical Chemistry*, American Chemical Society, Vol. 107, no. 44, pp. 9491-9494.
- Jackson, W.A., Arunagiri, S., Tock, R.W., Anderson, T., and Rainwater, K.A., 2004, "Electrochemical Generation of Perchlorate in Municipal Drinking Water Systems," *Journal of the American Water Works Association*, Vol. 96, no. 7, pp. 103-108.

## **Dr. Phil Smith**

### **Education**

- Ph.D. Environmental Toxicology, Texas Tech University 2000
- M.S. Clemson University's Institute of Wildlife and Environmental Toxicology 1997
- B.S. Chemistry & Biology, Murray State University 1989

### **Professional Experience**

- Associate Professor, Terrestrial Ecotoxicology, TTU, 2000-present
- Member of TTU Institute of Environmental & Human Health (TIEHH)

### **Research Interests**

- Ecotoxicology
- Wildlife Toxicology

### **Classes**

- ENTX 6371 Ecological Risk Assessment
- TOX 6115 Journal Club Seminar "Current Topics in Environmental Ecotoxicology"

### **Selected Publications**

- Brausch, John M., Smith, Philip N. 2009. Development of resistance to cyfluthrin and naphthalene among *Daphnia magna*. *Ecotoxicology*. (accepted).
- Brausch, John M., Smith, Philip N. 2009. Mechanism determination for resistance and cross-resistance to agrochemicals in *Thamnocephalus platyurus* (Crustacea: Anostraca). *Aquatic Toxicology*. (accepted).
- Dinehart, Simon, Smith, Loren M., McMurry, Scott T., Anderson, Todd A., Smith, Philip N., Haukos, David A. 2009. Toxicity of a glufosinate- and several glyphosate-based herbicides to juvenile amphibians from the Southern High Plains. *Science of the Total Environment*. (in press).
- Brausch, John M., Smith, Philip N. 2009. Pesticide resistance from historical agricultural chemical exposure in *Thamnocephalus platyurus* (Crustacea: Anostraca). *Environmental Pollution*. 157:481-487.
- Cheng Qiuqiong, Liu, Fujun, Smith, Philip N., Jackson, W. Andrew, McMurry, Scott T., Hooper, Michael J., Smith, Ernest E., Blount, Benjamin C., Valentin-Blasini, Liza, Anderson, Todd A. 2008. Perchlorate Distribution, Excretion, and Depuration in Prairie Voles and Deer Mice. *Water, Air, and Soil Pollution*. 192:127-139
- Liu, Jun, Cox, Stephen B., Beall, Blake, Brunjes, Kristina J., Pan, Xiaoping, Kendall, Ronald J., Anderson, Todd A., McMurry, Scott T., Cobb, George P., Smith Philip N. 2008. Effects of HMX Exposure Upon Metabolic Rate of Northern Bobwhite Quail (*Colinus virginianus*) in ovo. *Chemosphere*. 71:1945-1949.
- Rainwater, Thomas R., Selcer, Kyle W., Nespoli, Lisa M., Finger Adam G., Ray, David A., Platt, Steven G., Smith, Philip N., Densmore, Llewellyn D., Anderson Todd A., McMurry Scott T. 2008. Plasma vitellogenin in Morelet's crocodiles from contaminated habitats in northern Belize. *Environmental Pollution*. 153:101-109.
- Smith, Philip N., Cobb, George P., Godard-Coddling, Céline, Hoff, Dale, McMurry, Scott T., Rainwater, Thomas R., Reynolds, Kevin D. 2007. Contaminant exposure in terrestrial vertebrates. *Environmental Pollution*. 150:41-64.