

Economic Botany (BOT 3810) - Spring 2018
Department of Biological Sciences, Florida International University

- Instructor:** Dr. Bradley C. Bennett; **Phone:** 305-348-3586; **e-mail:** bennett@fiu.edu; **Office:** AHC 319A;
Office Hours: Tue 11:00 AM - 2:00 PM or by appointment
- Website:** <https://fiu.blackboard.com> [Google FIU Blackboard]
- Description:** Introduction to the plants that sustain human cultures. Economic Botany examines the major plant species that support, nourish and enrich our lives. The course covers main categories of useful plants (e.g., food, medicine, fibers, construction, psychoactive) and collection, domestication, cultivation, history, taxonomy & processing of representative species.
- Prereq.:** General Biology (BSC 1010) or Introductory Botany (BOT 1010) or the equivalent
- Time & Place:** Tue & Thu, 11:00 AM - 12:15 PM, PC 310
- Grading:** Two mid-terms exam (20% each), a final exam (20%), 25 one-page article synopses (20%), class attendance, participation and quizzes (20%). **Attendance is mandatory. No make-ups and no extra credit.** A = > 93, A- = 90-92, B+ = 87-89, B = 83-86, B- = 80 – 82, C+ = 77 – 79, C = 73 – 76, C- = 70 – 72, D+ = 67 – 69, D = 63 – 66, D- = 60 – 62, F = < 60.
- Early Alert:** To help you succeed in your academic courses, FIU utilizes an Early Alert system. Instructors are now able to notify students' academic advisors if there are concerns about class performance. If an alert is submitted, your academic advisor will send you a message via your Student Dashboard (accessed via your MYFIU page) to discuss ways to improve your performance. Please respond to any communication you receive from your academic advisor about an early alert. The goal of this program is to help you by identifying any issues as early on as possible and working to address them.
- Requirements:** Successful students will attend all classes and be punctual – **class begins promptly at 8:00 AM** and all quizzes will be given at the beginning of class (**no makeups**). Students must **complete all assigned readings before each class.** Students **must bring several 3"x 5" index cards** to each lecture.
- Class Policy:** **Cell phones must be turned off during all classes.** Laptop computer use will be limited to course related activities (i.e., **NO** Facebook, Twitter, or email). Students are expected to behave respectfully and professionally at all times. Disruptive students will be asked to leave. Students must adhere to the highest standards of academic behavior; cheating or plagiarism will not be tolerated. **NO** audio or visual recording!
- Readings:** Read all assignments before class. A one page synopsis of the articles **in boldface type** article is due on the dates indicated below **at the beginning of class** (except Delwiche & Timme 2011, which is due 10 Jan). Late synopses **will not be accepted.** You must **read all the articles before and class notes before each class.** Articles are posted on the class website.
- Simpson, B.B. and M. Conner-Ogorzaly. 2000. Economic Botany: Plants in our world. 3rd Edition. McGraw-Hill, New York. ISBN: 0072909382. EB (**optional**)

Schedule:

Date	#	Week	Topic	Readings
09 Jan	1	1	Introduction; What is a plant?; Plant Classification	Bennett 2009a , 2010b; Delwiche & Timme 2011, (EB1)
11 Jan	2	1	Plant Chemistry	Kabera et al. 2014 , Kamatou et al. 2013, Quirke & Bennett 2010
16 Jan	3	2	Plants and Material Culture; Resource Management	Bennett 1992 , Bennett 2010c, Middleton 2013
18 Jan	4	2	Agriculture and Domestication	Meyer et al. 2012 , Bennett 2010d, Fu et al. 2012, Willcox 2013
23 Jan	5	3	Food: Cereal Grains and Forage Grasses I	Klopfenstein et al. 2012 , Serratos Hernández 2009, Tzarfati et al. 2013 (EB5)
25 Jan	6	3	Food: Cereal Grains and Forage Grasses II	Callaway 2014 , Liao et al. 2013, Sang & Ge 2013
30 Jan	7	4	Food: Legumes	Abbo et al. 2009, Bitocchi et al. 2012, Moretzsohn, et al. 2013 (EB6)
01 Feb	8	4	Food: Leaves, Stems, and Roots	Bradbury & Denton 2010, Olsen & Schaal 1999, Spooner et al. 2005 (EB7)
06 Feb	9	5	Food: Fruits and Nuts (Temperate Regions) I	Harris et al. 2002, This et al. 2006, Bennett 2010e , EB3)
08 Feb	10	5	Food: Fruits and Nuts (Temperate Regions) II	Finn et al. 2013 , USDA ARS May-June 2011, Verde et al. 2013
13 Feb	-	6	Exam 1	No readings
15 Feb	11	6	Food: Fruits and Nuts (Tropical)	Ollitrault & Navarro 2011, Perrier et al. 2011 , Solieman et al. 2013
20 Feb	12	7	Food: Fruits and Nuts (Tropical)	Ashworth et al. 2011, Bai Lindout 2007, Gunn et al. 2011 , (EB4)
22 Feb	13	7	Spices and Herbs	Nabavi et al. 2015, Spence, 2013, Zhang et al. 2015 (EB8)
27 Feb	14	8	Cosmetics	Boga et al. 2013 , Chanchal & Swarnlata 2008, Shen et al. 2012
01 Mar	15	8	Vegetable Oils and Waxes	Campbell et al. 2014 , Dyer 2008, Jacoby 2010, (EB 9)
06 Mar	16	9	Hydrogels, Elastic latexes, and Resins	Coppen and Hone 1985 , Hayashi 2009, Lagenheim 1990
08 Mar	17	9	Medicinal Plants I	Ajazuddin et al. 2014, Bennett 2008 , Bennett & Balick 2013, (EB 11)
13 Mar	-	10	SPRING BREAK – No Class	No readings
15 Mar	-	10	SPRING BREAK – No Class	No readings
20 Mar	-	11	Exam 2	No readings
23 Mar	18	11	Medicinal Plants II	McClatchey et al. 2009 , Newman & Cragg 2012, Sun et al. 2008
27 Mar	19	12	Psychoactive Plant Drugs	Bennett 1992 , Bennett & Alarcón 1994, Halpern & Sewell 2005 (EB 12)

29 Mar	20	12	Plant Poisons	Bandara 2010, Lee 2007 , Roxas-Duncan & Smith 2012 (EB 13)
03 Apr	21	13	Stimulant Beverages	Edwards & Bennett 2005, Durak et al. 2014, Heck & Demejia 2007 (EB 14)
05 Apr	22	13	Alcoholic Beverages I	Bahre & Bradbury 1980, Behre 1999, Jennings 2005 (EB 15)
10 Apr	23	14	Alcoholic Beverages II	Bacilieri et al. 2013 , Dietler 2006, Hayashida 2008,
12 Apr	24	14	Fibers, Dyes, and Tannins	Gross & Strasburg 2010 , Palmer et al. 2012, Struik et al. 2000
17 Apr	25	15	Wood, Cork, and Bamboo	Peterman & Peterman n.d. , Thirgood 1971, Wegst 2006 (EB 16)
19 Apr	26	15	Ornamentals, Novel Uses	
26 Apr		16	Final Exam (note time: 7:30-9:30 AM)	

09 Jan - Lecture 1 (What is a plant?; Plant Classification)

Bennett, B.C. 2009a. Chapter 1. Ethnobotany and Economic Botany: Subjects in Search of a Definition.

B.C. Bennett, editor. UNESCO Encyclopedia of Life Support Systems. <http://eolss.net>.

Bennett, B.C. 2010b. Chapter 2. Plant Systematics: the *Sine Qua Non* of Economic Botany. B.C. Bennett, editor. UNESCO Encyclopedia of Life Support Systems. <http://eolss.net>.

Delwiche, C.F. and R.W. Timme. 2011. Plants. *Current Biology* 21:R417-R422.

11 Jan - Lecture 2 (Plant Chemistry)

Kabera, J.N., E. Semana, A.R. Mussa and X. He. 2014. Plant Secondary Metabolites: Biosynthesis, Classification, Function and Pharmacological Properties *Journal of Pharmacy and Pharmacology* 2: 377-392

Cushnie, T.P.T, B. Cushnie and A.J. Lamb. 2014. Alkaloids: An overview of their antibacterial, antibiotic-enhancing and antivirulence activities. *International Journal of Antimicrobial Agents* 44:377-386.

Kamatou, P., I. Vermaak, A.M. Viljoen, B.M. Lawrence. 2013. Menthol: A simple monoterpene with remarkable biological properties. *Phytochemistry* 96:15-25.

Quirke, M.J.E. and B.C. Bennett. 2010. Chapter 4. Chemistry of Natural Products. B.C. Bennett, editor. UNESCO Encyclopedia of Life Support Systems. <http://eolss.net>.

16 Jan - Lecture 3 (Plants and Material Culture; Resource Management)

Bennett, B.C. 1992. Plants and people of the Amazonian rainforests: The role of ethnobotany in sustainable development. *BioScience* 42:599-607

Bennett, B.C. 2010c. Chapter 6. Management and Economics of Plant Resources. B.C. Bennett, editor. UNESCO Encyclopedia of Life Support Systems. . <http://eolss.net>.

Middleton, B.A. 2013. Rediscovering traditional vegetation management in preserves: Trading experiences between cultures and continents. *Biological Conservation* 158:271-279.

18 Jan - Lecture 4 (Agriculture and Domestication)

Meyer, R.S., A.E. DuVal3 and H.R. Jensen 2012. Patterns and processes in crop domestication: an historical review and quantitative analysis of 203 global food crops *New Phytologist* 196:29-48.

Bennett, B.C. 2010d. Chapter 5. Plant Domestication and the Origins of Agriculture. B.C. Bennett, editor. UNESCO Encyclopedia of Life Support Systems. <http://eolss.net>.

Willcox, G. 2013. The roots of cultivation in southwestern Asia. *Science* 341:39-40.

23 Jan - Lecture 5a (Food: Cereal Grains and Forage Grasses)

Klopfenstein, T.J. G.E. Erickson, and L.L. Berger. 2012. Maize is a critically important source of food, feed, energy and forage in the USA. *Field Crops Research* 153:5-11.

Serratos Hernández, J.A. 2009. Origin and diversity of maize in the American Continent.

Tzarfati, R. Y. Saranga, V. Barak, A. Gopher, A.B. Korol, and S. Abbo. 2013. Threshing efficiency as an incentive for rapid domestication of emmer wheat. *Annals of Botany* 112:829-837.

25 Jan - Lecture 5b (Food: Cereal Grains and Forage Grasses)

Callaway, E. 2014. The birth of rice. *Nature* 514:S58-S59.

Liao, J.-L. et al. 2013. Phylogeny and maternal donors of the tetraploid species with St genome (Poaceae: Triticeae) inferred from CoxII and ITS Sequences. *Biochemical Systematics and Ecology* 50:277-285.

Peleg, Z., T. Fahima, A.B. Korol, S. Abbo and Y. Saranga. 2011. Genetic analysis of wheat domestication and evolution under domestication. *Journal of Experimental Botany* 62:5051-5061.

Sang, T. and S. Ge. 2013. Understanding rice domestication and implications for cultivar improvement. *Current Opinion in Plant* 16:139-146.

30 Jan - Lecture 6 (Food: Legumes)

Bitocchi E. et al. 2012. Mesoamerican origin of the common bean (*Phaseolus vulgaris* L.) is revealed by sequence data. *PNAS* 109: E788–E796

Abbo, S., Y. Saranga and Z. Peleg. 2009. Reconsidering domestication of legumes versus cereals in the ancient Near East. *Quart. Rev. Biol.* 84:29-50.

Moretzsohn, C.M. et al. 2013. A study of the relationships of cultivated peanut (*Arachis hypogaea*) and its most closely related wild species using intron sequences and microsatellite markers. *Annals of Botany* 111:113-126.

01 Feb - Lecture 7 (Food: Leaves, Stems, and Roots)

Bradbury, J.H. and I.C. Denton. 2010. Simple method to reduce the cyanogen content of gari made from cassava. *Food Chemistry* 123:840-845.

Olsen, K.M. and B.A. Schaal. 1999. Evidence on the origin of cassava: Phylogeography of *Manihot esculenta*. *Proc. Natl. Acad. Sci. USA* 96:5586–5591.

Spooner, D. K. McLean, G. Ramsay, R. Waugh and G.J. Bryan. 2005. A single domestication for potato based on multilocus amplified fragment length polymorphism genotyping. *PNAS* 102:14694-14699.

06 Feb - Lecture 8a (Food: Fruits and Nuts (Temperate Regions))

Bennett, B.C. 2010e. Chapter 7. Plants as Food. B.C. Bennett, editor. UNESCO Encyclopedia of Life Support Systems. <http://eolss.net>.

Harris, S.A., J.P. Robinson and B.E. Juniper. 2002. Genetic clues to the origin of the apple. *Trends in Genetics* 18:426-430.

This, P., T. Lacombe and M.R. Thomas. 2006. Historical origins and genetic diversity of wine grapes. *Trends in Genetics* 22:511-519.

08 Feb - Lecture 8b (Food: Fruits and Nuts (Temperate Regions))

Finn, C.E. et al. 2013. The Chilean Strawberry (*Fragaria chiloensis*): Over 1000 Years of Domestication. *Hortscience* 48:418-423.

USDA ARS May-June 2011, pages 2, 4-16.

Verde, I. et al. 2013. The high-quality draft genome of peach (*Prunus persica*) identifies unique patterns of genetic diversity, domestication and genome evolution. *Nature Genetics* 45:487-494.

13 Feb - No Readings (Exam I)

15 Feb - Lecture 9a (Food: Fruits and Nuts (Tropical))

Ollitrault, P. and L. Navarro. 2011. *Citrus*. Pages 623-662 in M.L. Badenes and D.H. Byrne, eds., Fruit Breeding, Handbook of Plant Breeding 8, Springer, Philadelphia, PA.

Perrier, X. et al. 2011. Multidisciplinary perspective on banana (*Musa spp.*) domestication. PNAS 108:11311-11318.

Soliman, T.H.I., M.A.H. El-Gabry, and A.I. Abido. 2013. Heterosis, potency ratio and correlation of some important characters in tomato (*Solanum lycopersicum* L.). *Scientia Horticulturae* 150:25-30.

20 Feb - Lecture 9b (Food: Fruits and Nuts (Tropical))

Ashworth, V., H. Chen, and M.T. Clegg. 2011. *Persea*. Pages 173-189 in C. Kole, editor. Wild Crop Relatives: Genomic and Breeding Resources, Tropical and Subtropical Fruits. Springer-Verlag, Berlin.

Bai, Y. and P. Lindhout. 2007. Domestication and breeding of tomatoes: What have we gained and what can we gain in the future? *Annals of Botany* 100: 1085-1094.

Gunn, B.F., L. Baudouin, and K.M. Olsen. 2011. Independent origins of cultivated coconut (*Cocos nucifera* L.) in the Old World Tropics. PLoS ONE 6(6): e21143.

22 Feb - Lecture 10 (Spices and Herbs)

Nabavi, S.M., A. Marchese, M. Izadi, V. Curti, M. Daglia and S.F. Nabavi. 2015. Plants belonging to the genus *Thymus* as antibacterial agents: From farm to pharmacy. *Food Chemistry* 173:339-347.

Spence, C. 2013. Multisensory flavour perception. *Current Biology* 23:R365-R369.

Zhang, Ch-R., A.A. Dissanayake, K. Kevseroglu and M.G. Nair. 2015. Evaluation of coriander spice as a functional food by using in vitro bioassays. Food Chemistry 167:24-29.

27 Feb - Lecture 11 (Cosmetics)

Boga, C., C. Delpivo, B. Ballarin, M. Morigi, S. Galli, G. Micheletti and S. Tozzi. 2013. Investigation on the dyeing power of some organic natural compounds for a green approach to hair dyeing. Dyes and Pigments 97:9-18.

Chanchal, D. and S. Swarnlata. 2008. Novel approaches in herbal cosmetics. *Journal of Cosmetic Dermatology* 7:89-95.

Shen, T., G.H. Li, X.N. Wang and H.X. Lou. 2012. The genus *Commiphora*: a review of its traditional uses, phytochemistry and pharmacology. *J Ethnopharmacol.* 142:319-330.

01 Mar - Lecture 12 (Vegetable Oils and Waxes)

Campbell, D.N., D.L. Rowland, R.W. Schnell, J.A. Ferrell and A.C. Wilkie. 2014. Developing a castor (*Ricinus communis* L.) production system in Florida, U.S.: Evaluating crop phenology and response to management. Industrial Crops and Products 53:217-227.

Dyer, J.M., S. Stymne, A.G. Green, and A.S. Carlsson. 2008. High-value oils from plants. *Plant J.* 54:640-655.

Jacoby, M. 2010. Sowing the seeds of oil customization: Breeding and biotechnology team up to deliver seed oils with tailored profiles. *Chem. Eng. News* 88:52-55.

06 Mar - Lecture 13 (Hydrogels, Elastic latexes, and Resins)

Coppen, J.J.W. and G.A. Hone. 1985. Gum naval stores: Turpentine and rosin from pine resin. Non-Wood Forest Products 2, Natural Resources Institute. Fao, Rome. [available at: <http://www.fao.org/docrep/V6460E/V6460E00.htm>]

Hayashi, Y. 2009. Production of natural rubber from Para rubber tree. *Plant Biotechnology* 26:67-70.

Lagenheim, J. 1990. Plant Resins. *The American Scientist* 78:16-24.

08 Mar - Lecture 14 (Medicinal Plants)

Ajazuddin, A. Alexander, A. Qureshi, L. Kumari, P. Vaishnav, M. Sharma, S. Saraf a and S. Saraf b. 2014. Role of herbal bioactives as a potential bioavailability enhancer for active pharmaceutical ingredients. *Fitoterapia* 97:1-14.

Bennett, B.C. 2008. Doctrine of Signatures through Two Millennia. Herbalgram. 78:34-45.

Bennett, B.C. and M.J. Balick. 2013. Does the name really matter? The importance of botanical nomenclature and plant taxonomy in biomedical research. *Journal of Ethnopharmacology* [Epub ahead of print]

13 Mar - SPRING BREAK (No Readings)

15 Mar- SPRING BREAK (No Readings)

20 Mar - No Readings (Exam II)

22 Mar - Lecture 14b (Medicinal Plants)

McClatchey, W.C., G.B. Mahady, B.C. Bennett, L. Shiels, and V. Savo. 2009. Recent developments in CNS-active natural products from ethnobotanical sources. *Pharmacology and Therapeutics* 123: 239–254.

Newman, D.J. and G.M. Cragg. 2012. Natural products as sources of new drugs over the 30 years from 1981 to 2010. *J. Nat. Prod.* 75:311-335.

Gaziano, J.M. and P. Greenland. 2014. When should aspirin be used for prevention of cardiovascular events? *JAMA* 312:3025-3026.

Sun, A.Y., Q. Wang, A. Simonyi, and G.Y. Sun. 2008. Botanical phenolics and brain health. *Neuromol. Med.* 10:259–274.

27 Mar – Lecture 15 (Psychoactive Plant Drugs)

Bennett, B.C. 1992. Hallucinogenic plants of the Shuar and related indigenous groups in Amazonian Ecuador and Peru. *Brittonia* 44:483-493.

Bennett, B.C. and R. Alarcón. 1994. *Osteophloeum platyspermum* (A.DC.) Warburg and *Virola duckei* A.C. Smith (Myristicaceae): Newly reported as hallucinogens from Amazonian Ecuador. *Econ. Botany* 48:152-158.

Halpern, J.H. and R.A. Sewell. 2005. Hallucinogenic botanicals of America: A growing need for focused drug education and research. *Life Sciences* 78:519-526.

29 Apr Lecture 16 (Plant Poisons)

Bandara, V. 2010. A review of the natural history, toxinology, diagnosis and clinical management of *Nerium oleander* (common oleander) and *Thevetia peruviana* (yellow oleander) poisoning. *Toxicon* 56:273-281.

Lee, M.R. 2007. Solanaceae III: Henbane, hags and Hawley Harvey Crippen. *J.R. Coll. Physicians Edinb.* 37:77-84.

Roxas-Duncan, V.I. and L.A. Smith. 2012. Of beans and beads_ ricin and abrin in bioterrorism and biocrime. *J Bioterr. Biodef.* 2012, S7.

03 Apr - Lecture 17 (Stimulant Beverages)

Edwards, A. and B.C. Bennett. 2005. Diversity of methylxanthine content in *Ilex cassine* L. and *Ilex vomitoria* Ait.: Assessing sources of the North American stimulant cassina. *Economic Botany* 59:275-285.

Durak, A. U. Gawlik-Dziki and L. Pecio. 2014. Coffee with cinnamon – Impact of phytochemicals interactions on antioxidant and anti-inflammatory in vitro activity. *Food Chemistry* 162:81-88.

Heck, C.I. and E.G. de Mejia. 2007. Yerba Mate Tea (*Ilex paraguariensis*): A comprehensive review on chemistry, health implications, and technological considerations. *Journal of Food Science* 72:R138-R151.

05 Apr – Lecture 18a (Alcoholic Beverages)

- Bahre, C.J. and D.E. Bradbury. 1980. Manufacture of mescal in Sonora, Mexico. *Economic Botany* 34:391-400.
- Behre K.E. 1999. The history of beer additives in Europe: A review. *Veget. Hist. Archaeobot.* 8:35-48.
- Jennings, J. 2005. **La chichera y el patrón: Chicha and the energetics of feasting in the prehistoric Andes.** *Archeological Papers of the American Anthropological Association* 14:241-259.

10 Apr - Lecture 18b (Alcoholic Beverages)

- Bacilieri, R. et al. 2013. **Genetic structure in cultivated grapevines is linked to geography and human selection.** *BMC Plant Biology* 2013, 13:25
- Dietler, M. 2006. Alcohol: Anthropological Archaeological Perspectives. *Annu. Rev. Anthropol.* 35:229–249.
- Hayashida, F.M. 2008. Ancient beer and modern brewers: Ethnoarchaeological observations of chicha production in two regions of the North Coast of Peru. *J. Anthro. Archaeology* 27: 161–174.

12 Apr - Lecture 19 (Fibers, Dyes, and Tannins)

- Gross, B.L. and J.L. Strasburg. 2010. **Cotton domestication dramatic changes in a single cell.** *BMC Biology* 8:137
- Palmer, S.A. et al. 2012. Archaeogenomic Evidence of Punctuated Genome Evolution in *Gossypium*. *Mol. Biol. Evol.* 29:2031-2038.
- Struik, P.C., S. Amaducci, M.J. Bullard, N.C. Stutterheim, G. Venturi, and H.T.H. Cromack. 2000. Agronomy of fibre hemp (*Cannabis sativa* L.) in Europe. *Industrial Crops and Products* 11:107–118.

17 Apr - Lecture 20 (Wood, Cork, and Bamboo)

- Peterman, F. and A. Peterman. No date. **African Americans and the sawmills of Big Cypress — a brief history.** *U.S. National Park Service.*
- Thirgood, J.V. 1971. The historical significance of oak. In: *Oak Symposium Proceedings.* Northeastern For. Exp. Sta. For. Serv. USDA, Upper Darby, PA, 1-18.
- Wegst, U.G.K. 2006. Wood for sound. *American Journal of Botany* 93:1439-1448.

19 Apr - Lecture 21 (TBA) - No Readings

- Rashida, U., M. Ibrahim, S. Yasin, R. Yunus, Y.H. Taufiq-Yap, and G. Knothe. 2013. Biodiesel from *Citrus reticulata* (mandarin orange) seed oil, a potential non-food feedstock. *Industrial Crops and Products* 45:355-359.
- Parawira, W. 2010. Biodiesel production from *Jatropha curcas*: A review. *Scientific Research and Essays* 5:1796-1808.
- Koh, M.Y. and T.I. Mohd. Ghazi. 2011. A review of biodiesel production from *Jatropha curcas* L. oil. *Renewable and Sustainable Energy Reviews* 15:2240-2251.

Optional

- Bennett, B.C. 2010. Chapter 3. Twenty-five Important Plant Families. B.C. Bennett, editor. *UNESCO Encyclopedia of Life Support Systems.* <http://eolss.net>.
- Bennett, B.C. 1997. An introduction to the Seminole people and their plants, Part I: History and Ethnology. *The Palmetto* 17(2):20-21,24.
- Bennett, B.C. 1997. An introduction to the Seminole people and their plants, Part II: Seminole plant use. *Palmetto* 17(2):16-17,22.