

CONSERVATION | CULTIVATION | COMMERCE

The Future of Ginseng and Forest Botanicals

SYMPOSIUM



July 12-14, 2017
MORGANTOWN, WV



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The Future of American Ginseng and Other Appalachian Forest Botanicals Symposium

Conservation, Cultivation, Commerce

July 12-14, 2017 | Waterfront Place Hotel | Morgantown, West Virginia

(schedule is subject to change)

Wednesday: American Ginseng

8:00-9:00 AM CHECK-IN/REGISTRATION

9:00 - 9:15 WELCOME

9:15-10:15 OPENING KEYNOTE "Taking the Broad View: How Are Wild Ginseng Populations Faring and When Does Conservation Policy Need to Change?" – *James B. McGraw*

PRESENTATIONS: CURRENT RESEARCH ON AMERICAN GINSENG

10:15-10:30 Spreading the Ginseng Gospel: Case study from Watuagua County Cooperative Extension – *Jim Hamilton*

10:30-10:45 Supply and Regulation of Wild American Ginseng – *Greg Frey, James Chamberlain, Jeff Prestemon*

10:45-11:00 A Survey of the Genetic and Phytochemical Diversity of American Ginseng in Western North Carolina – *Jonathan Horton, H. David Clarke, Jennifer Rhode Ward, John Brock, Jess Burroughs, & Nicholas Freeman*

11:00-11:15 Break

11:15-11:30 American ginseng status assessment on four National Forests in the Mid-Atlantic U.S. – *John Young, David Smith, and Tim King*

11:30-12:30 PANEL DISCUSSION ON THE FUTURE OF GINSENG CONSERVATION AND INDUSTRY *With James B. McGraw from WVU, Paul Hsu from Hsus Ginseng, Susan Leopold from United Plant Savers, Michael McGuffin from American Herbal Products Association and David Cooke from Grow Appalachia. Moderated by Ed Fletcher from Herbal Ingenuity*

12:30-1:30 Lunch (provided at hotel)

1:30-2:45 Can Wild Ginseng Regenerate New Plants from Replanted Rhizome? – *Robert Layton Beyfuss*

2:45-3:00 An examination of mycorrhizal symbiosis in forest grown American ginseng, and the influence of mycorrhizal infection on root ginsenoside content – *Tanner Filyaw and Sarah Davis*

3:00-3:15 Demographic response of American ginseng to three natural canopy disturbances common in mixed mesophytic forests – *Jennifer L. Chandler*

3:15-3:30 Assessing the Status of American Ginseng from Harvest and Monitoring Data – *JP Schmidt and Jenny Cruse-Sanders*

3:30-4:00 Questions for speakers/discussion

4:00-5:00 PANEL DISCUSSION ON LAW ENFORCEMENT *With Chad Taylor from NC Dept. of Agriculture, Brad Hadley from MO Dept. of Conservation, and Ron Ollis from OH Dept. of Natural Resources*

5-6:30 *Cash Bar*

6:30-7:30 EVENING DINNER AT HOTEL AND SPEAKER: Ginseng in Appalachian Folk Medicine – *Phyllis Light*

Thursday: Appalachian Forest Botanicals

PRESENTATIONS: CURRENT RESEARCH ON APPALACHIAN FOREST BOTANICALS AND CONSERVATION/ MANAGEMENT OF WILD POPULATIONS

9:00-9:15 Recap and Announcements

9:15-9:30 Conservation status of forest botanicals: What do we know and why does it matter? – *Danna Leaman*

9:30-9:45 An Overview of NatureServe’s Conservation of Native Plants - *Ann Frances*

9:45-10:00 An American ginseng story: NatureServe’s work in Indiana and Illinois - *Leah Oliver*

10:00-10:15 Questions for speakers

10:15-10:30 Break

10:30-10:45 The Potential Dangers of Black Cohosh (*Actaea racemosa L.*) Dietary Supplement Use and How to Address Safety Concerns with Botanical Education – *Laura Price, Karen Johnson, Sunshine Brosi*

10:45-11:00 Black Cohosh: Harvest Impacts, Population Response and Implications for Sustainable Management of this and Other Medicinal Forest Products – *James Chamberlain and Christine Small*

11:00--11:15 Characteristics of Woodland Herbal Users in the United States: Summary from an Epidemiological Study - *Termeh Feinberg and Kim Innes*

11:15 – 11:30 Review of Effects of Growing Methods on Pharmacological profiles of Herbal Medicines – *Meghan Gonick*

11:30-12:00 Questions for speakers/discussion

12:00-1:00 Lunch (provided at hotel)

1:00-1:30 Producing wild leek in forest farming under northern climates - *Lapointe, L., Dion, P.-P., Denis, M.-P., Bussières, J. & Bernatchez, A.*

1:30-1:45 *Sanguinaria canadensis L.*, Bloodroot, historical and potential uses – *Meghan Gonick*

1:45-2:00 Root Report: Measuring the Market for Forest Medicinals – *Steve Kruger, John Munsell, James Chamberlain, Jeanine Davis, Ryan Huish, and Steve Prisley*

2:00-2:30 Questions and Discussion

2:30-2:45 Making Medicine: Sourcing and Sustainability in the Herbal Products Supply Chain – *Ann Armbrecht*

2:45- 3:45 HERBALIST PANEL: PAST AND PRESENT USES AND ANALOGS AND SOURCING – *Kathleen Maier, Jennifer Gerrity, Phyllis Light*

3:45-4:00 Wrap-Up/Conclusion

4:00-5:00 POSTER SESSION WITH MUSIC

- Ginsenoside Profiles in American Ginseng (*Panax quinquefolius L.*) in Western North Carolina - *Jessica Burroughs, David Clarke, Jonathan Horton, Jennifer Rhode Ward, and John Brock*
- Connecting Appalachian Icons: The importance of conserving plant-animal mutualisms in a changing world - *Amy M. Hruska, Michael C. Elza, and James B. McGraw*
- Antidermatophytic Effect of Black Walnut hull, *Juglans nigra* - *Rosanna King, Andrea Lutac, Natalie Rubio, Jenna Yutzy, and Rebecca Rashid Achterman*
- Partial root harvest of *Panax quinquefolius L.* (American ginseng): a non-destructive method for harvesting root tissues for ginsenoside analysis - *Ian Sabo, Jonathan L. Horton, H. David Clarke, and Jennifer Rhode Ward*
- Flower Essences: Sustainable Supplements from Forest, Field, and Garden - *Katherine Ziff*
- Alkaloid Content in Forest Grown Goldenseal – *Grady Zuiderveen, Eric Burkhart, Josh Lambert, and Mike Jacobson*

DINNER ON YOUR OWN (*not provided*) – Participants are free to explore Morgantown

Optional meet-up after dinner at Apothecary Ale House & Café to try ginseng meade provided by Hawk Knob (227 Chestnut St, Morgantown)

Friday Farming – Growing the Network by Supporting the Cultivation

8:00 - 9:30 AM APPALACHIAN BEGINNERS FOREST FARMERS BREAKFAST MIXER

9:30 – 10:00 AM Overview of Appalachian Beginning Forest Farmers Coalition - *John Munsell*

10:00 – 10:30 AM American Ginseng Pharm Overview – *Anna Plattner*

10:30 - 11:00 AM Use of Natural Fungicides with Organic Ginseng Production — *Robert Eidus*

11:00 – 12:00 FOREST FARMING PANEL DISCUSSION CURRENT TRENDS AND OPPORTUNITIES – *Jennifer Gerrity from Mountain Rose Herbs, Chip Carroll from United Plant Savers, Marc Williams from Plants & Healers International, Tanner Filyaw from Rural Action, Stephen Gruget from Rareroot*

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2:00-6:00 PM FOUNDATIONS OF FOREST FARMING AT HARDING’S GINSENG FARM

(NOTE: Must register separately as space is limited.)

Class taught by Chip Carroll, Larry Harding, and Marc Williams

Topics will cover basic botany and plant families of forest botanicals, growing ginseng and goldenseal, seed collection, and value-added products

Abstracts

Armbrecht, Ann. Sustainable Herbs Project, Montpelier, VT. a.armbrecht@gmail.com “Sourcing and Sustainability in the Herbal Products Supply Chain”

I started the Sustainable Herbs Project (SHP) to create educational resources for consumers about the herbal products industry so that we can all become more informed about the issues involved in the industry and how to best support sustainable and ethical sourcing of high quality raw material. The SHP website will be a series of short videos following herbs through the supply chain to make visible the lives of the people and places involved in bringing these plants to market. In this presentation, I will introduce the project by showing several brief videos and then discuss ways the SHP is working to raise awareness about issues relating to the conservation and commerce of forest botanicals.

Beyfuss, Robert Layton. Retired Agriculture Agent and American Ginseng Specialist for Cornell University Cooperative Extension, NY. rlb14@cornell.edu “Can Wild Ginseng Regenerate New Plants from Replanted Rhizome?”

Wild American ginseng is a plant species of International Concern and is listed on CITES Appendix 2. Current conservation efforts are geared towards protecting existing wild populations by establishing regulations that, among other rules, are intended to prohibit harvest before plants have a chance to reproduce. This presentation will address the following questions: 1) Can wild ginseng regenerate new plants from replanted rhizome/neck fragments containing intact apical buds (vegetative reproduction)? If so, 2) Will plants that have regenerated from rhizome fragments become reproductive sooner than plants arising from seeds planted from harvested plants? and 3) What are the possible conservation/regulatory implications for this data?

Burroughs, Jessica, David Clarke, Jonathan Horton, Jennifer Rhode Ward, and John Brock.

University of North Carolina Asheville. jburroug@unca.edu “Ginsenoside Profiles in American Ginseng (*Panax quinquefolius* L.) in Western North Carolina”

American ginseng (*Panax quinquefolius* L.) is a threatened perennial understory plant endemic to eastern deciduous forests. Ginsenosides, the plant’s secondary metabolites, give the plant its medicinal qualities which make it sought after on the Asian market and, therefore, intensely harvested. Information on phytochemical profiles of populations would give more insight on creating cultivars labeled for specific medicinal properties, ideally reducing the demand for wild harvested ginseng. Genetic diversity of ginseng is thought to be more widespread in the Appalachian region, due to the glacial refugia created during the Pleistocene epoch. Ginsenoside profile diversity may also be more widespread in the Appalachian region and may be linked to genetic diversity. We analyzed the ginsenoside profiles in 174 roots from 17 NC populations and 2 Virginia populations. Six ginsenosides (Rb1, Rb2, Rg1, Re, Rd, and Rc) were characterized and quantified using methanol-reflux extraction and high performance liquid chromatography (HPLC). Preliminary analysis has confirmed variation in chemotypes with most plants exhibiting RG (Re/Rg1 < 1) chemotypes and only a few populations showing RE (Re/Rg1 > 2) or Intermediate (1 < Re/Eg1 < 2) chemotypes, which could be a result of outplanting commercial seeds.

Chamberlain, James and Christine Small. USDA Forest Service, Blacksburg, VA.

jchamberlain@fs.fed.us “Black Cohosh: Harvest Impacts, Population Response and Implications for Sustainable Management of this and Other Medicinal Forest Products”

Tens of thousands of pounds of black cohosh are harvested every year from Appalachian hardwood forests. The sale of this forest botanical contributes significantly to household incomes throughout the region. Unfortunately, few efforts have been made to understand the ecological impacts of harvesting and how to manage the resource sustainably. Without active management, the potential for negative impacts and population declines is tremendous. We have been studying the impacts of experimental harvests of black cohosh since 2004. After 3 years of harvesting at a rate of 66% we found significant reductions in foliage areas, stem production, mean and maximum height. Populations showed no evidence of recovery after 1 year. Results suggest that black cohosh is very responsive to harvest intensities and long recovery periods are needed to ensure long-term health of the populations. Subsequent analysis of population recovery after seven years indicates limited recovery and potential threats to long-term persistence of natural populations. Another challenge for sustainable management of this medicinal product is determining how much harvestable stock is available in a patch. Few methods exist to estimate below-ground biomass based on above-ground metrics. We developed a method to estimate marketable biomass of black cohosh which can be used to improve management activities. Our findings have significant implications on managing this medicinal plant which may be appropriate for other medicinal forest products.

Chandler, Jennifer L. Appalachian State University, Boone, NC. jchandler23@gmail.com
“Demographic response of American ginseng to three natural canopy disturbances common in mixed mesophytic forests”

An understory plant’s ability to exploit alterations to the light environment caused by canopy disturbance leads to changes in population dynamics. The purpose of this work was to determine if population growth of American ginseng increases in response to additional light inputs caused by canopy disturbance, or alternatively, declines due to long-term selection under low light conditions. We parameterized stage-based matrix models to quantify the demographic response of ginseng to three natural forest canopy disturbances. Asymptotic growth rates, stochastic growth rates, and simulations of transient dynamics were used to quantify population-level responses. Population growth rates at each disturbed site increased the transition period directly after canopy disturbance. Stochastic models revealed that growth rates increased in simulations that included disturbance matrices relative to those that excluded disturbance. Transient models indicated that population size was larger for each population when disturbances were modeled. American ginseng is likely pre-adapted to take advantage of canopy gaps and light influx to a degree, and this pre-adaptation may be due to long-term selection under dynamic old-growth canopies. This study provides evidence to aid our understanding of the population-level response of understory herbs to disturbances whose frequency and intensity are predicted to increase as global climates shift.

Eidus, Robert. North Carolina Ginseng & Goldenseal Co., Marshall, NC. reidus@frontier.com “Use of Natural Fungicides with Organic Ginseng Production”

I present results of work from a 2000 SERA grant from the USDA about determining alternatives to chemicals to fight aboveground and soil fungus. I also discuss Davis’s research study on goldenseal, and the role of goldenseal soil washes in soil-born funguses. The benefits of above-ground spraying with horsetail are presented, as the best over others tested. Additional fungicides such as plants (e.g. chamomile), hydrogen peroxide, bleach, and horticultural sulfur will also be discussed.

Feinberg, Termeh and Kim Innes. University of Maryland. TFeinberg@som.umaryland.edu
“Characteristics of Woodland Herbal Users in the United States – Summary from an Epidemiological Study”

Botanicals (herbs) are grown, harvested, and used by many cultures worldwide for a variety of purposes, including the promotion of health or mitigation of disease. Although crude herbs are harvested within the U.S., consumer use of herbal preparations is largely relegated to dietary supplement status by the Federal Drug Administration. Population-based, epidemiological studies focusing on Nonvitamin, Nonmineral (NVNM) dietary supplement use have been conducted in nationally-representative populations in the U.S., and indicate approximately 17.9% of those in the U.S. consumed a NVNM in 2012. Limited studies have explored the patterns and correlates of supplement use on specific populations, while even fewer studies have been conducted to determine the characteristics of populations using specific botanicals. The Appalachian region of the US is a woodland, ecological habitat responsible for a significant portion of U.S. botanical exports. Four woodland botanicals consistently harvested within the Appalachian region are Ginkgo, Ginseng, Goldenseal, and Black Cohosh. The goal of this exploratory study was to determine the characteristics of Ginkgo, Ginseng, Goldenseal, and Black Cohosh dietary supplement consumers across the US in 2007 and 2012.

Filyaw, Tanner R. and Sarah C. Davis. Environmental Studies, Ohio University, OH.
tanner@ruralaction.org “Mycorrhizal Symbiosis in Forest-Grown American ginseng (*Panax quinquefolius*) and the Relationship Between Mycorrhizal Colonization and Root Ginsenoside Content”

American ginseng (*Panax quinquefolius* L.) is a valuable medicinal plant that has been harvested from the forests of eastern North America for over 300 years, and commercially cultivated since the late 1800's. Arbuscular Mycorrhizal Fungi (AMF) are symbiotic soil organisms that colonize plant roots, and often contribute to enhanced growth by increasing the uptake of water and nutrients. The role of AMF in the production of American ginseng has become a topic of increasing interest, but forest-based research on this subject is limited. This study quantified AMF colonization in six-year old forest-grown ginseng roots, resolved the relationship between AMF colonization and root ginsenoside content, and identified species of AMF present in forest production sites. Roots from four production sites were measured for AMF colonization, and ginsenosides Rg1, Re, Rb1, Rc, Rb2, and Rd were quantified by High Performance Liquid Chromatography (HPLC). AMF spores were extracted from soil samples by wet-sieving, and identified morphologically. Results indicate that AMF colonization varied significantly between sites ($p < 0.05$), but no significant differences in ginsenoside content were resolved between sites ($p = 0.104$). Furthermore, ginsenoside content was determined to not be significantly influenced by AMF colonization ($p = 0.0823$). Significant inverse relationships between AMF colonization and Rg1 ($p = 9.826e-05$) were detected, and there was a positive correlation between AMF colonization and Re ($p = 0.007$). Due to high spore degradation, *Rhizophagus intraradices* (formerly *Glomus intraradices*) was the only species of AMF identified between production sites.

Frances, Anne. NatureServe, Arlington, VA. Anne_Frances@natureserve.org “An Overview of NatureServe’s Conservation of Native Plants”

The conservation of North American native plant species is the mission of NatureServe’s Botany Department. The conservation of native plants, especially those experiencing threats and population declines, is dependent on accurate information about each species location, population health, and protection needs. In cooperation with Natural Heritage Programs in each U.S. state, Canadian Conservation Data Centres, and other collaborators, NatureServe uses a long-standing, standardized, and vetted methodology to evaluate each plant species for its risk of imperilment and conservation priorities. To carry out species-specific assessments at the state, provincial, national, and global levels, the Botany Department develops and maintains the taxonomic, geographic, ecological, and conservation data that determine priorities that support the protection and management of the rarest and most vulnerable plant species.

Frey, Greg, James Chamberlain, and Jeff Prestemon. Forest Service, Southern Research Station, Forest Inventory & Analysis, Blacksburg, VA. jchamberlain@fs.fed.us “Supply and Regulation of Wild American Ginseng”

American ginseng (*Panax quinquefolius*) root is highly valued as traditional medicine in Asia. High harvest levels for the export market led to concerns about the long-term sustainability of the plant which resulted in many states and the federal government implementing harvest regulations. Such regulations have the potential to affect income generation in rural communities in Appalachia and the Ohio valley. Using harvest data from the US Fish and Wildlife Service and price data, we estimated wild ginseng root economic supply and demand models that identify how quantity supplied responds to price, how economic crises affect harvests, and how regulations affect quantities supplied. We found evidence that quantities supplied are related negatively to price over a portion of the long-run supply curve, indicating that increasing harvest pressure in the short-run may be reducing inventories and reducing production possibilities in the long run. This finding is similar to open access resources such as fisheries in international waters. We uncovered limited evidence that increases in local unemployment rates increased harvest. Further, our analysis reveals that federal regulation banning exports of roots from plants under 5 years old has led to a shift in the long-

run supply curve. This result could be due to the slow natural rate of population recovery from harvesting. We discuss implications of the shape of the supply curve for conservation and regulation.

Gonick, Meghan. University of Bridgeport Acupuncture Institute, CT. meghanonick@gmail.com
“Review of Effects of Growing Methods on Pharmacological profiles of Herbal Medicines”

This presentation originated as a naturopathic doctorate thesis reviewing examining the research on the effects of growing conditions on qualities and quantities of constituent in medical herbs. Herb based medicines form a large portion of the *materia medica* and therapies currently used in Naturopathic and other natural Medicine. Currently, more than 400,000 tons of medical and aromatic plants are traded yearly. The majority of these plants are procured by collection, and nearly 15,000 of the estimated 50,000-70,000 species used for medicine and cosmetics are threatened or endangered raising environmental and future supply concerns as the industry continues to grow. Some herbs valued for their medical properties are quite difficult to produce agriculturally and are usually wildcrafted. Other plants are wildcrafted because practitioners of many traditional medicine system regard the natural plants as more potent. Although there is very little research comparing the effects of growing herbs in their natural environments versus otherwise, there may in many cases be validity to regarding wildcrafted plants as more potent. Many of the medically effect compounds and secondary metabolites, which fluctuate in response to predation and environmental changes. This suggest questions of growing methods may be a valid concern for medical use.

Gonick, Meghan. University of Bridgeport Acupuncture Institute, CT. meghanonick@gmail.com
“*Sanguinaria canadensis* L., Bloodroot, historical and potential uses”

This is a review of the identification, distribution, and growing conditions of *Sanguinaria canadensis*. With a detailed discussion of the Plant's chemical profile and concentrations of importantalkaloids and other constituents and their studied effects. This leads to a review of the traditional uses by early Americans and the medical community prior the last hundred years including its importance in dental care. An examination of the publication criticizing its use as an escharotic treatment for skin cancers, shows that it did not make claims as to damage of healthy skin (as many seem to think). Currently it is used in Naturopathic medicine primarily to treat cervical lesions, and as an antibiotic, but many practitioners avoid using it due to concerns not supported by literature or clinical evidence. Numerous recent *in vitro* and animal studies show its effectiveness against cancer. Its emerging uses as an animal growth enhancer and garden plant will be described.

Hamilton, Jim. County Extension Director for North Carolina Cooperative Extension, Boone, NC. jim_hamilton@ncsu.edu “Spreading the Ginseng Gospel: Case Study from Watauga County Cooperative Extension”

Over the last 4 years, Cooperative Extension has been providing on-farm demonstrations and workshops with forest landowners and intensive ginseng growers in northwestern North Carolina. Wild-simulated ginseng is a viable forest crop option for underutilized woodlands in prime ginseng growing habitat in northwestern NC (and many parts of the Appalachians). Interest in the county's “ginseng program” and programmatic efforts have yielded participation by over 100 landowners who have sown over 3,000 pounds of seed in the last 4 years. In 2014, Watauga County was home to the first felony conviction of ginseng theft on private property in North Carolina due in part to a coordinated and proactive educational approach directed towards law enforcement and the district attorney's office. Successful elements of Extension's

wild-simulated ginseng production program will be presented to highlight how other organizations can garner interest from landowners in establishing ginseng on underutilized forest land.

Horton, Jonathan, H. David Clarke, Jennifer Rhode Ward, John Brock, Jess Burroughs, and Nicholas Freeman. University of North Carolina Asheville. jhorton@unca.edu “A Survey of the Genetic and Phytochemical Diversity of American Ginseng in Western North Carolina”

American ginseng (*Panax quinquefolius*) is a threatened but valuable woodland herb, distributed throughout forests in eastern North America. Previous research has shown that composition of medicinal compounds, ginsenosides, and genetic profiles vary within and among western North Carolina (WNC) populations. Since 2015, we have sampled plants from 17 populations in WNC and two outlying populations in Virginia. Root tissue was non-destructively subsampled for ginsenoside analysis via High Performance Liquid Chromatography, and leaflet samples were collected for analysis of DNA microsatellite regions to assess genetic diversity. A majority of WNC populations were dominated by the RG ($Re/Rg1 < 1$) chemotype, while three populations had individuals with I ($1 < Re/Rg1 < 2$) and RE ($Re/Rg1 > 2$) chemotypes. Of the two populations in Virginia, one had only RE chemotypes, and the other had a mix of RG and I chemotypes. Genetic variation was higher within than among all populations. We hope to correlate genetic markers with specific chemotypes to help determine how much of the variation in ginsenoside production is genetic versus environmentally influenced. These genetic and environmental influences on ginsenoside production will be further explored by establishing a common garden for individuals collected across our sampling range.

Hruska, Amy M., Michael C. Elza, and James B. McGraw. University of Hawai‘i at Mānoa. “Connecting Appalachian Icons: The importance of conserving plant-animal mutualisms in a changing world.” hruska.amy@gmail.com

Alteration of mutualistic interactions can negatively affect population growth and persistence. As a declining species with economic and cultural value, and a life history similar to many other understory herbs, American ginseng has become a focal species for many demographic and conservation-based studies. However, little research has been conducted to understand a critical mutualism for ginseng populations: seed dispersal. Anecdotally, ginseng seeds have been classified as gravity dispersed; but, the production of red, fleshy-fruits suggest a mutualism with animals. Trail cameras were used to identify thrushes, particularly wood thrushes (*Hylocichla mustelina*), and small mammals as potential dispersers. Through feeding studies, thrushes were identified as the primary seed dispersers, while small mammals were identified as predators. Radio transmitters were used to determine potential dispersal distances by wood thrushes and compared with field observations of wood thrush presence/absence and ginseng distribution at 28 populations. Wood thrushes were found to be predictive of ginseng distribution within a site. Dispersal by wood thrushes is likely to be important for the persistence of ginseng as harvest, deer browse, and climate change continue to threaten populations. However, wood thrushes are also a declining species – linking ginseng and wood thrush conservation.

King, Rosanna, Andrea Lutac, Natalie Rubio, Jenna Yutzy, and Rebecca Rashid Achterman. Bastyr University, Kenmore, WA. herbalist.rosanna.king@gmail.com “Antidermatophytic Effect of Black Walnut hull, *Juglans nigra*”

Athlete’s foot, ringworm, jock itch and fungal nail infections are all caused by dermatophytes, making dermatophytosis the most common type of fungal infection. More than \$500 million is spent worldwide to treat these fungal infections. *Juglans nigra* has a long history of use by herbalists in the treatment of fungal infections. Several studies have been published on the antifungal activity of the related *Juglans regia*, which

is used in Europe and Asia, but little research has been published exploring anti-fungal effects of *J. nigra*, which is endemic to eastern North America and preferred by American herbalists. Fresh and dry black walnut hull preparations are used with the fresh often considered more potent than the dry hull. The objective of this project was to investigate the difference in anti-dermatophyte activity of fresh and dry ethanolic, aqueous, and glycerin extracts of black walnut hull.

Kruger, Steve, John Munsell, James Chamberlain, Jeanine Davis, Ryan Huish, and Steve Prisley. Virginia Tech, Blacksburg, VA. skruger@vt.edu “RootReport: Measuring the Market for Forest Medicinals”

Few American non-timber forest products (NTFPs) are systematically tracked, meaning that the size and distribution of harvests, value of products and trends in production over time are often unknown. This increases risks for potential growers, harvesters and buyers, and is a barrier to effectively managing wild populations. RootReport (www.rootreport.frec.vt.edu) was created as a Virginia Tech extension program to measure output for medicinal plants other than ginseng being harvested in deciduous forests in the eastern US. A survey was developed and sent to primary buyers of medicinal plants in 15 states, many of whom were also interviewed. The project was designed to that data in a format usable for multiple stakeholders, including participants. An online platform hosts results from previous years, and connects users with other resources, such as materials about growing and stewarding medicinal plants, and other institutions and organizations that support NTFP production. The presentation will show results compiled from three years of data collection and discuss the future of the project.

Lapointe, L., P.-P. Dion, M.-P. Denis, J. Bussi eres and A. Bernatchez. Laval University, Quebec City, Canada. Line.Lapointe@bio.ulaval.ca “Producing wild leek in forest farming under northern climates”

Over the last 10 years, we have been running experiments on wild leek yield in forest farming. We also gained knowledge on its biology. Wild leek thrives under low temperatures more typical of early than late spring. Under more northern climates, the plant annual cycle is compressed which reduces bulb growth. Planting wild leek under trees leafing out late (oak, ash or walnut) prolongs wild leek’s growing period and improves annual growth. Natural high density conditions negatively affect plant growth and appear to expose the plant to outbreak pests such as spotted snake millipede. Other factors that improve growth of wild leek are the application of organic fertilizers and gypsum and the presence of a litter. Further testing is needed to optimise fertilization (formula, application rate and frequency) along with pest management studies.

Leaman, Danna. Canadian Museum of Nature, Ottawa, Canada. djl@green-world.org “Conservation status of forest botanicals: what do we know and why does it matter?”

The current focus of the botanicals industry on sustainable supplies has extended down the supply chain to management of raw materials for high quality and compliance with good manufacturing practice requirements, all of which is beneficial to consumers and producers. But are these initiatives sufficient to conserve the targeted plant species, whether wild-collected or cultivated, so that use of these resources is sustainable? A broader ecological approach and commitment to sustainability within the botanicals industry is necessary to the long-term survival of this industry sector and the plant species on which it depends.

McGraw, James B. Department of Biology, West Virginia University.

James.McGraw@mail.wvu.edu "Taking the Broad View: How Are Wild Ginseng Populations Faring and When Does Conservation Policy Need to Change?"

American ginseng has been harvested from the wild to supply the Asian traditional medicine trade in North America since the early 1700s. However, only since 1975 have federal and state regulations been in place to regulate this trade, and the harvest practices supporting it. Using data from a unique long-term formal census of 30 natural populations in 7 states, my lab examined recent trends from 2004-2014 as an indicator of how wild ginseng populations are faring. Combined with demographic modeling 'experiments' using these census data, my students have also examined alternative projections for the future of ginseng over coming decades, including factors that explain variation in population growth and viability. Over the decade (2004-2014), 25 of 30 ginseng populations declined in size from their initial numbers. The mean decline over this timeframe was 30%. The observed immediate reasons for the decline were (1) harvest; particularly illegal harvest, which was prevalent in about half the populations, and (2) deer browse; also prevalent, and distributed unevenly among populations. Age-specific demographic data clearly showed that the current 5-year age restriction is insufficient to protect wild populations. Additional analyses showed large between population variation in age-specific growth and reproduction, suggesting that an alternative criterion for harvest is needed. Also negatively impacting populations were hot, dry summers that curtailed growth and seed production, as well as intense natural or human-caused tree canopy disruption. In the long-term, landscape level changes to the forest, combined with climate change, are projected to impact ginseng populations negatively in the coming century. While regulations imposed in response to CITES listing may only impact harvest practices, they must be considered in light of the broader array of stresses experienced by natural populations. The precarious state of wild populations even in the absence of harvest pressure suggests that wild harvest practices need to be further adjusted toward the 'stewardship' end of the harvest spectrum. At the same time, forest 'farming' practices using regional ginseng ecotypes that relieve harvest pressure on wild populations need to be encouraged through any regulatory reform that takes place.

Oliver, Leah. NatureServe, Arlington, VA. Leah_Oliver@natureserve.org "An American ginseng story: NatureServe's work in Indiana and Illinois"

American ginseng, *Panax quinquefolius* L., is perhaps the most iconic medicinal plant in the eastern North America. Although information on ginseng harvest is traced back to European settlement, recent information has raised concerns about the species conservation due to threats including illegal harvest, herbivory, and invasive species. NatureServe, a non-profit organization, utilizes species conservation statuses assessments at the state, national, and global levels. Working collaboratively, botanists from NatureServe, the Indiana Natural Heritage Program, the Illinois Division of Forest Resources, independent contractors, and the U.S. Geologic Survey collected current population and genetic data in Indiana and Illinois. The population and genetic data collected between July and August of 2016 will inform the conservation status of American ginseng in these states. In all, 79 sites across 55 counties in Indiana and Illinois were surveyed. Only 29 sites had at least 24 plants, the threshold required to maintain the maximum genetic variability within populations. Of the 79 sites, nearly all had threats, regardless of whether they occurred on public or private land. The age structure of plants across Indiana and Illinois show a greater percentage of juvenile plants than mature, reproducing plants. This pattern of many juveniles and few mature plants is seen in other population demography studies of this species, and is considered a signature of over-harvest. Botanists involved in this study are considering how this information will impact conservation measures in these states. Forthcoming genotype results will help

clarify the provenance of plants sampled to determine whether they come from local or non-local seed sources.

Price, Laura, Karen Johnson, and Sunshine Brosi. Frostburg State University, Frostburg, MD. Imprice0@frostburg.edu “The Potential Dangers of Black Cohosh (*Actaea racemosa* L.) Dietary Supplement Use and How to Address Safety Concerns with Botanical Education”

Black cohosh, or *Actaea racemosa* L. (= *Cimicifuga racemosa* L. (Nutt.); Ranunculaceae), is a herbaceous, perennial herb native to North America. Historically, many Native Americans used the rhizome of the plant to treat a broad range of conditions (Nyree et al., 2002). European settlers adopted these practices, but black cohosh lost popularity among U.S. doctors in the early 19th century. A resurgence of black cohosh in dietary supplement markets today has resulted in regained popularity among women trying to combat the symptoms of menopause (Nyree et al., 2002). This leads to health concerns that lie in a lack of vigorous medical testing, non-stringent regulation of dietary supplement labels, and contamination with other species. The potential for dietary supplement contamination is more likely with herbs like black cohosh, which have not been successfully cultivated on a large scale and must be obtained through wild harvest (Predny, 2006). There are several look-alike species among North American *Actaea* and this can easily lead to misidentifications among the genus (Dr. Brosi, personal communication, 2015). With the assistance of Dr. Sunshine Brosi of Frostburg State University, students created an educational flow-chart to assist herb harvesters in the field and address both health and ecological issues that result from black cohosh harvest.

Sabo, Ian, Jonathan L. Horton, H. David Clarke, and Jennifer Rhode Ward. Biology Department, University of North Carolina at Asheville. isabo@unca.edu “Partial root harvest of *Panax quinquefolius* L. (American ginseng): a non-destructive method for harvesting root tissues for ginsenoside analysis”

Panax quinquefolius L. (American ginseng) is an economically important herbaceous woodland perennial plant native to eastern North America. The roots have long been prized in Asian medicine, and are beginning to be used more in North America and Europe for herbal supplements. This use has led to an increased demand for the roots of this species, resulting in overharvesting, increasing rarity, and loss of genetic diversity in much of its native range. Much research is being directed at ginsenosides, the triterpenoid saponin glycosides that are the major active medicinal compounds found in ginseng. Given the conservation concerns regarding wild *Panax quinquefolius*, we began experimenting with a partial root harvest method in 2014 for extracting tissue for ginsenoside analysis without killing or causing long-term harm to the plant. Preliminary results revealed that 51 of the 55 (93%) plants subjected to partial root harvest in 2014 came back in 2015 and three of the four plants that did not emerge in 2015 returned in 2016. Of the 46 plants sampled in 2015, 43 (93%) emerged in 2016. These results suggest that this method could prove to be an effective way for ginsenoside researchers to mitigate their impact on wild ginseng populations.

Schmidt, JP and Jenny Cruse-Sanders. University of Georgia, GA. jps@uga.edu “Assessing the Status of American Ginseng from Harvest and Monitoring Data”

We summarize trends on the status of wild populations of American ginseng (*Panax quinquefolius*) by drawing inferences from the combined visualization and statistical analysis of four separate sources of data on ginseng populations: 1) Yearly harvests submitted to the U.S. Fish and Wildlife Service by states permitting the export of wild-harvested ginseng for the years 2000-2014. 2) Annual counts of ginseng

populations on plots in Arkansas and North Carolina, 2000-2015. 3) Roots per lb. for Georgia dating from the 1984 – present. 4) Locations of ginseng populations throughout the eastern state and federal agency data and herbarium records. We find strong evidence that ginseng harvesting has increased since 2005, which represents a reversal of declines in harvesting from a high point from the mid-1980s to 1990, and that harvesting pressure has: 1) altered the age structure of populations such that mature reproductive plants are a smaller component with obvious implications for growth rates, and 2) led to population extirpations. We also found evidence that harvesting pressure may be leading to selection for reproduction at smaller sizes. Further research into social-ecological conditions seems key to understanding how ginseng populations respond and will persist in the face of heavy harvest pressure.

Young, John, David Smith, and Tim King. USGS Leetown Science Center, Kearneysville, WV. jyoung@usgs.gov “American ginseng status assessment on four National Forests in the Mid-Atlantic U.S.”

In an effort to better understand the distribution, population density, and genetic structure of American ginseng (*Panax quinquefolius*) on mid-Atlantic US National Forests, the USGS, at the request of the USFS, conducted a comprehensive study on four National Forests in 2014-2015. Field surveys, guided by a randomized field survey design and species distribution modeling, were conducted on the Monongahela (WV), Wayne (OH), Pisgah (NC), and Nantahala (NC) National Forests. Data collected in field surveys was used in subsequent statistical population density estimates, population simulation under various harvest and stewardship scenarios, and genetic analysis. We found American ginseng plants generally widely distributed in accordance with predicted habitat, but at low densities in field plots. The highest densities were found on the Nantahala NF, followed by the Pisgah NF, the Monongahela NF, and lowest densities on the Wayne NF. Through population survival modeling we found that probability of extinction decreases with stewardship behaviors, especially re-planting of seeds, but the probability of extinction was never zero. Simulated population viability was highly dependent on initial population size, survivorship scenario, harvest timing, and stewardship type. Results of genetic analysis were highly variable among sample sites, with some sites highly diverse and others consisting largely of selfed progeny. In general, we found that more genetic diversity is held *among* populations within Forests (51%) than within populations (36%), and only a small fraction of genetic diversity is held among the four Forests (13%). These findings suggest that care should be taken to maintain as many individual populations as possible as a large proportion of the existing genetic variation is apparent among populations, and remaining populations, while widely dispersed, currently exist at low densities and are susceptible to harvest pressure.

Ziff, Katherine. Briarwood Studies, Athens, OH. katherineziff@aol.com “Flower Essences: Sustainable Supplements from Forest, Field, and Garden”

Flower essences are a complementary healing approach addressing emotional/feeling states. Originated in England between 1928 and 1935 by Dr. Edward Bach, flower essences are now developed and used in many parts of the world. They are similar to homeopathic remedies in that they derive their treatment not from biochemical properties but from energies that expand through dilutions. Because of the dilution process, a small number of flower blossoms result in a great many 30 ml treatment bottles for individuals, making flower essences a sustainable modality. This paper gives an overview of how flower essences are made. It also presents a chart of six forest botanical flower essences, four of them listed by United Plant Savers as at-risk species. Properties of these essences as derived by their developers are shown in the chart.

Zuiderveen, Grady, Eric Burkhart, Josh Lambert, and Mike Jacobson. Pennsylvania State University, State College, PA. gjz5033@psu.edu “Alkaloid Content in Forest Grown Goldenseal”

Goldenseal (*Hydrastis canadensis*) is an Appalachian forest herb whose rhizome is used to treat inflammation and digestive disorders. Due to overexploitation concerns and significant demand, goldenseal is a crop option for forest farming. Despite its popularity as an herbal medicine, there is little information on the effects of harvest timing and habitat-related production factors on its medicinal constituents (i.e., Berberine, Hydrastine, and Canadine). The need to satisfy market demand with sustainably harvested, quality assured product requires a better understanding of goldenseal chemistry. Results (using High Performance Liquid Chromatography) in central Pennsylvania suggest that time of harvest can dramatically influence the alkaloid content in the dried root and rhizomes. Alkaloid content was found to peak in July (fruiting stage) and October (senescent stage), while samples between those times fell well below current recommended therapeutic and industry constituent levels (c.f., United States Pharmacopeia). My current research further examines harvest timing effects by expanding the range of the previous study to include (1) aerial and root portions; (2) time of day harvested; (3) full seasonal phenology; and (4) drying temperature. Additionally, I am conducting more exhaustive geographic sampling for associated habitat conditions in Pennsylvania and nearby states. The results of this study will identify production, harvest and post-harvest factors that can influence quality control in forest farmed goldenseal. This, in turn, may help forest farmers garner higher prices and a stronger market edge compared with wild crafted product – contributing to conservation of remaining wild populations by creating a more desirable product.

MORGANTOWN RESTAURANTS

SUMMER, 2017

The following restaurants are categorized by general price range. In the first 3 lists are restaurants within walking distance of Waterfront Hotel (within about 1 mile). At the bottom are restaurants you might consider if you want to drive.

ARRANGED ROUGHLY BY PRICE

Low price range

(\$10 entrees, +/- \$5)

1. **Mountain State Brewing Company** (craft beers, pub food, wood fired pizza)
2. **Black Bear Burritos** (American take on Mexican with vegetarian options)
3. **Iron Horse Tavern** (Comfy Spot for pub grub and brews)
4. **Tailpipes Restaurant** (Retro joint for innovative burgers and shakes)

Medium price range

(\$20 entrees +/- \$5)

5. **Saffron Indian Cuisine** (Choose your heat level in this authentic Indian restaurant with a wide selection)
6. **Chaang Thai.** (Not the best Thai in M'town [see below] but OK and offers gluten-free)
7. **Oliverio's Ristorante** (Nice Italian with patio on railtrail. Close to Waterfront)

Higher price range

(\$30 entrees +/- \$5)

8. **Sargasso** ('cutting edge' cuisine, nice wine selection, walk to south on railtrail)
9. **Table 9** ('New American' fare, tapas style, close to hotel, river side dining)
10. **Morgantown Flour & Feed** ('made from scratch' fine dining; close to hotel, on railtrail, outside dining possible)

Alternatives to consider for those wishing to drive:

- (1) **Ta-Khrai Thai Café** (the best Thai in M'town),
- (2) **Saigon Pho Kitchen** (inexpensive but good Vietnamese pho),
- (3) **Hill & Hollow** (Victuals and libations; nouvelle cuisine, locally sourced ingredients, pricey but good; a little farther walk north on railtrail, or drive in historic Seneca Center),
- (4) **Tin 202** (Tapas and entrees on High St; cocktails),
- (5) **Bourbon Prime** (in Waterfront Hotel; must-try cocktail is the 'Almost Heaven'. Good steaks.) Bon appetit!

