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Course description
This course on Landscape Genetics provides a unique opportunity for interdisciplinary training and international collaboration. The seminar is an excellent opportunity for both skill development and networking for graduate students planning to incorporate genetic, ecological, and spatial data in their current or future research. The course caters to students in both basic and applied ecology, especially conservation/population genetics, landscape ecology and conservation biology. Landscape Genetics will be concurrently offered at six universities in North America and Europe giving students the opportunity to learn from experts around the world and work with peers from outside institutions.

A key objective of landscape genetics is to study how landscape modification and habitat fragmentation affect organism dispersal and gene flow across the landscape. Landscape genetics requires highly interdisciplinary specialized skills making intensive use of technical population genetic skills and spatial analysis tools (spatial statistics, GIS tools and remote sensing). Even when students receive disciplinary training in these areas, educational programs often lack the necessary linkage and synthesis among disciplines. This linkage can only be accomplished after experts from each discipline work together to develop guiding principles for this new research area.

The Landscape Genetics course unites some of the most active landscape genetics groups in North America and Europe, drawing on the experience of experts both in population genetics and landscape ecology with the goal of providing an integrated overview of approaches for testing the effect of landscape pattern on dispersal and gene flow, a key topic of landscape genetics. Each course meeting will start with a live web-cast lecture by an expert on the topic that introduces foundations and methods and highlights points for discussion in local seminar groups. After breaking out into local course group discussion, a web-based discussion across campuses will wrap up the weekly topic.

Practical experience in landscape genetics is a key component of the course. Students will get hands-on experience applying various methods in the lab portion of the course. In addition, students have the opportunity to participate in a cross-university group project (optional, see course requirements) focusing on a specific issue in landscape genetics or analysis of a particular dataset. Approximately two students from each project will be invited to the synthesis meeting (Toronto field campus) where we will discuss projects and work on turning them into manuscripts for publication.
Prerequisites

There are no official prerequisites for this course. A background in population genetics will be extremely helpful, but not required (but be prepared to do some additional background reading). Similarly previous GIS skills or exposure to concepts in landscape ecology is required, but this experience will be helpful.

Course topics

- Landscape genetics framework
- Measuring gene flow
- Alternative views of landscapes
- Spatial analysis framework
- Identifying discrete populations
- Incorporating landscape data
- Matrix resistance approaches in landscape genetics
- Distance-based methods
- Model selection and validation
- Role of simulation modeling
- Network-based methods
- Contemporary gene flow
- Landscape genetics of adaptive variation

Requirements

Students may choose to take the course for 3 or 4 credits. I recommend the 3 credit option for students who have a general interest in landscape genetics. For students integrating landscape genetics in their research, I encourage the four credit option which includes a project. The project will allow students to take full advantage of the training and networking offered by the coordinated nature of the course. Only students who elect to do the project will be eligible for consideration to attend the synthesis meeting at the Toronto field campus in May.

Three credit option:
- Read 1-2 papers before each course meeting
- Attend pre-lecture background discussion (9-9:30)
- Attend lectures (offered live across universities) (9:30-10:30)
- Participate in local discussion of lecture and related paper(s) (10:30-11)
- Contributed to cross-campus discussion (immediately following local discussion) (11-11:30)
- Contribute to local wrap-up discussion (11:30-11:50)
- Complete weekly hands-on exercise (3-5)
- Produce three reports based on hand-on exercises.

Four credit option:
- Complete requirements above
- Participate in interdisciplinary, inter-university student project group. Students will select from topics related to the in-class topics and groups will collaborate with one of the instructors (from across all institutions). Students will be evaluated on:
  o research plan for group project
  o presentation to local seminar group (15-20 min meeting style talk)
  o contribution to group manuscript
  o Although groups will be across universities, grading for Wyoming students will be conducted by me.

Grading
Details:
Grades will be assigned based on a percentage of total points. Late assignments will not be accepted without exceptional circumstances and prior arrangement. Students are allowed to miss one week of class without penalty. If you have an emergency (illness, death in the family, etc.) or other extenuating circumstances, please contact me to make arrangements before any deadlines.

Questions - To prepare for class discussion, students are expected to read the assigned papers and bring 4-5 questions (typed, to be turned in). There are 13 weeks with discussion, students are expected to turn in questions for 12 of these weeks (lowest score will be dropped). Students are also expected to contribute to oral discussion (in local discussion and large-group discussion).

Weekly exercises – students are expected to participate in and complete the hands-on exercise each week.

Exercise Reports – Students will be required to write up a report on three of the weekly exercises (one from each third of the course). Specific guidelines will be given in class.

Project - The project will include a research plan (2-3 page summary), evaluation of group participation, a meeting-style 15-20 min presentation and a report (that will function as a draft manuscript for future development). Additional grading information will be provided as the class progresses.
### Schedule

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<thead>
<tr>
<th>Meeting</th>
<th>Topic</th>
<th>Presenter(s)</th>
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<tr>
<td>Jan. 11</td>
<td>Course overview, Introduction to Molecular Markers</td>
<td>Murphy</td>
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<td>Jan. 18</td>
<td>Introductions¹</td>
<td>All</td>
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<td>Jan. 25</td>
<td>Landscape Genetics Overview¹</td>
<td>Spear</td>
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<td>Feb. 1</td>
<td>Gene Flow</td>
<td>Waits</td>
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<td>Feb. 8</td>
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<td>Feb. 15</td>
<td>Spatial Analysis</td>
<td>Fortin</td>
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<td>Feb. 22</td>
<td>Identifying discrete populations</td>
<td>Balkenhol, Manel, Fortin</td>
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<td>Feb. 29</td>
<td>Landscape Data</td>
<td>Bolliger</td>
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<td>March 7</td>
<td>Matrix Resistance</td>
<td>Murphy</td>
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<td>March 14</td>
<td>SPRING BREAK</td>
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<td>March 21</td>
<td>Distance-based methods</td>
<td>Cushman</td>
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<td>March 28</td>
<td>Model Selection</td>
<td>Wagner</td>
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<td>April 4</td>
<td>Simulation Modeling</td>
<td>Balkenhol, Landguth</td>
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<td>April 11</td>
<td>Network-based Methods</td>
<td>Murphy</td>
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<td>April 18</td>
<td>Contemporary Gene Flow</td>
<td>Dyer</td>
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<td>April 25</td>
<td>Adaptive Variation</td>
<td>Manel</td>
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<td>May 2</td>
<td>Presentation of Group Projects¹</td>
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¹These weeks are not options for one of the exercise reports.