Biodiversity and Ecology (BDE) 345
Invasion Ecology

2017, Second semester;
3 lectures and 1 practical per week. 16 credits

Course coordinator:
Prof Jaco Le Roux (JLR)
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Other lecturers:
Dr John Measy (JM; jmeasey@sun.ac.za)
Dr Florencia Yanelli (FL; florenciayanelli@gmail.com)
Prof Dave Richardson (DR; rich@sun.ac.za)

Invited guest lectures are highlighted in yellow.

Course Assistant:
Ms Janette Law-Brown
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janette@sun.ac.za

Aims: This course will cover a variety of topics concerned with invasive species, the processes governing their success, their impacts and management.

On completion of this module you should be familiar with the following concepts:

Invasion Ecology A – An Introduction to Invasion Science
- What are invaders and why should we care about them?
- A brief history of invasion ecology and invasion science
- Terminology used in invasion ecology
- Conceptualizing the invasion process

Invasion Ecology B – Transport Vectors and Pathways
- What’s the difference between a vector and a pathway?
- How does human-mediated transport differ from natural colonization?
- Transport vectors
- Which species are transported via which vectors?
- The dynamics of transport pathways

Invasion Ecology C – Propagules
- What are propagules?
- Donor regions and propagule condition
- Propagule size and number
- Propagule pressure

Invasion Ecology D – Evolution of invaders
- Founding process
- Losses and gains in genetic variability via transport mechanisms
- Genetics and post-release success
- Local adaptation and life history evolution

Invasion Ecology E – Trends in Numbers of Invaders
- Invasion rates through time
- Geographic patterns in numbers of invaders
- Why are some taxonomic groups over-represented?

Invasion Ecology F – Disturbance
- What is disturbance?
- What types of disturbance promote invasion?
- Restoration and disturbance
- Agriculture and urbanization as disturbance
- Biotic disturbance
- Global change and alien species

Invasion Ecology G – Modelling the geographical spread of invasive species
- What is geographical spread?
- Why do we need to model geographical spread?
- The reaction-diffusion model
- Long-distance dispersal
- Directional dispersal
- Stratified dispersal
- Other forms of heterogeneity

Invasion Ecology H – Establishment success: The influence of biotic interactions
- Conceptual issues
- Resistance to invasion
- Facilitation of establishment

Invasion Ecology I – Ecological processes and the spread of alien species
- Population growth
- Biotic interactions
- The role of heterogeneity
- Lag times
- Boom and bust

Invasion Ecology J – Impacts of invasive species
- A conceptual framework
- Genetic impacts
• Individual impacts
• Population impacts
• Community impacts
• Ecosystem impacts
• Landscape, regional and global impacts
• Perception and recognition of impacts
• Integrating perception with ecological determinants of impact
• Finding common currencies
• A cross-stage impact formula

**Invasion Ecology K – Management**

• Explanation vs. prediction vs. risk assessment
• The quest to predict invaders
• Screening risky species
• Screening risky transport vectors and pathways
• Early warning systems and eradication of invasion foci
• Controlling populations of widespread invaders
• Novel ecosystems


» **Scientific literature (see Web CT)**

**Language implementation for this module:**
The Department of Botany and Zoology recognizes English as the international academic language and a medium through which science is generally communicated. It is thus our endeavor to ensure that each and every one of our students is proficient to communicate through the medium of English. We will, however, accommodate our Afrikaans students to the best of our ability.

The following language option will be implemented in this BDE module: Lectures will be offered in English only.

The materials for learning will be made available as follows:
- All compulsory reading material will be provided in English. Compulsory reading material (excluding published material) will also be provided in Afrikaans unless it is not reasonably practicable to do so.
- Module frameworks/study guides will be available in Afrikaans and English.

- Question papers for tests, examinations and other summative assessments will be available in Afrikaans and English. Students may answer all assessments and submit all written work in either Afrikaans or English.

**Assessment of module:** This course is not based on continuous evaluation. In this module you will write two theoretical tests; one semester test and one class test, hand in two practical reports, and write one exam paper. The final mark is the sum of your semester mark (40%) and the mark obtained in the exam (60%). Your semester mark comprises your theory tests (60%; of which 60% comprises your semester test mark and 40% your class test mark) and your practical reports (40%; you have two reports, both will contribute equally to this mark). To qualify for the exam you must have obtained at least 40% for the semester mark. An exam mark of at least 40% is required to obtain a final mark of 50%. To pass the module you must obtain a final mark of 50%.

PLEASE NOTE: Some guest lectures (highlighted in yellow) will be given throughout the course and you will be tested on the contents of these during the semester test and exam.

**Test and exam dates:**
*Semester test: 03-10-2017 – venue and time to be confirmed.*
*Class test: To be announced – venue and time to be confirmed.*
*Exam 1: 06-11-2017 at 14h00*
*Exam 2 (2nd opportunity): 29-11-2017 at 14h00*

**Hand in Date: Practical Reports:**
Prof Le Roux will notify you as to the hand-in of the practical proposal and report - but note preliminary dates below.

No time extensions will be allowed for handing in practical reports and reports handed in late will not be marked.
**Lecture programme:** This course consists of 38 lectures. Lectures are held on Monday 10am, Tuesday 8am and Friday 11am in JS Marais Building, Room 3028

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<thead>
<tr>
<th>Lecture</th>
<th>Date</th>
<th>Topic</th>
<th>Lecturer</th>
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<tbody>
<tr>
<td>1</td>
<td>17/7</td>
<td>Course background information and brief introduction</td>
<td>JLR</td>
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<tr>
<td>2</td>
<td>18/7</td>
<td>Invasion science - History, terminology, concepts</td>
<td>JLR</td>
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<td>3</td>
<td>21/7</td>
<td>Vectors and pathways I</td>
<td>JLR</td>
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<td>4</td>
<td>24/7</td>
<td>Vectors and pathways II</td>
<td>JLR</td>
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<td>5</td>
<td>25/7</td>
<td>Species traits and invasiveness</td>
<td>JLR</td>
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<td>6</td>
<td>28/7</td>
<td>Propagules and propagule pressure</td>
<td>JLR</td>
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<td>7</td>
<td>31/7</td>
<td>Propagule pressure and population growth</td>
<td>JLR</td>
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<td>8</td>
<td>1/8</td>
<td>Biotic interactions</td>
<td>JLR</td>
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<td>9</td>
<td>4/8</td>
<td>Evolutionary dynamics of biological invasions</td>
<td>JLR</td>
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<td>10</td>
<td>7/8</td>
<td>Applications of Molecular Ecology</td>
<td>JLR</td>
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<td>11</td>
<td>8/8</td>
<td>Impacts – conceptualization</td>
<td>JLR</td>
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<td>12</td>
<td>11/8</td>
<td>Predicting and understanding the distributions of alien species in novel ranges</td>
<td>JLR</td>
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<tr>
<td>13</td>
<td>14/8</td>
<td>Marine environments</td>
<td>Tammy Robinson</td>
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<tr>
<td>14</td>
<td>15/8</td>
<td>Dispersal strategies, patterns of spread</td>
<td>FY</td>
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<td>15</td>
<td>18/8</td>
<td>Population growth, biotic interactions</td>
<td>FY</td>
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<td>16</td>
<td>21/8</td>
<td>Novel ecosystems</td>
<td>FY</td>
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<td>17</td>
<td>22/8</td>
<td>Climate change and Invasions</td>
<td>FY</td>
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<td>18</td>
<td>25/8</td>
<td>Restoration</td>
<td>FY</td>
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<td>19</td>
<td>28/8</td>
<td>False impressions: The need for empirical evidence in invasion biology</td>
<td>FY</td>
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<tr>
<td>20</td>
<td>29/8</td>
<td>Disturbance</td>
<td>JM</td>
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<tr>
<td>21</td>
<td>1/9</td>
<td>Habitat alteration</td>
<td>JM</td>
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<td><strong>RECESS 2 – 10 September</strong></td>
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<tr>
<td>22</td>
<td>11/9</td>
<td>Global change biology</td>
<td>JM</td>
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<td>23</td>
<td>12/9</td>
<td>Resistance</td>
<td>JM</td>
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<td>24</td>
<td>15/9</td>
<td>Facilitation</td>
<td>JM</td>
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<td>25</td>
<td>18/9</td>
<td>Ethics of eradication</td>
<td>JM</td>
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<tr>
<td>26</td>
<td>19/9</td>
<td>Invasion rates</td>
<td>JM</td>
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<tr>
<td>27</td>
<td>22/9</td>
<td>Geographic patterns</td>
<td>JM</td>
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<tr>
<td>28</td>
<td>26/9</td>
<td>Taxonomic representation</td>
<td>JM</td>
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<tr>
<td>29</td>
<td>29/9</td>
<td>National strategies and best practice management</td>
<td>DR</td>
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<tr>
<td>30</td>
<td>2/10</td>
<td>Quantifying the economic impacts of invasions</td>
<td>DR</td>
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<tr>
<td>31</td>
<td>3/10</td>
<td>Prevention is better than cure – managing pathways, early detection, rapid response, eradication</td>
<td>DR</td>
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<tr>
<td>32</td>
<td>6/10</td>
<td>Best practice management and assessments of South African programs</td>
<td>DR</td>
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<tr>
<td>33</td>
<td>9/10</td>
<td>Working for Water</td>
<td>DR</td>
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<tr>
<td>34</td>
<td>10/10</td>
<td>Weed biological control</td>
<td>DR</td>
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<td>35</td>
<td>13/10</td>
<td>Conflicts of interest in managing invasive species</td>
<td>DR</td>
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<tr>
<td>36</td>
<td>16/10</td>
<td>Fire and its use in the management of invasive species; impacts of invasions on fire</td>
<td>DR</td>
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<tr>
<td>37</td>
<td>17/10</td>
<td>Local eradication of predatory alien</td>
<td>DR</td>
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Practical programme: This course consists of 12 practical sessions of which three will be contact sessions. Practicals will be held Wednesdays from 14.00-17.00 JS Marais 3028.

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Lecturer</th>
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<tbody>
<tr>
<td>1</td>
<td>19/07</td>
<td>Introduction and outline</td>
<td>JLR</td>
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<td>2-3</td>
<td>19/07-16/08</td>
<td>Self-study, research proposal</td>
<td>NA</td>
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<td>4</td>
<td>23/08</td>
<td>Visit to PPRI - Stellenbosch</td>
<td>JLR</td>
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<td>3</td>
<td>16/08</td>
<td>Research project proposal hand in!</td>
<td>JLR</td>
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<td>TBA</td>
<td>TBA</td>
<td>Saturday! Fieldtrip Overstrand</td>
<td>JLR, JM, DMR</td>
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<tr>
<td>4-10</td>
<td>20/07 - 09/10</td>
<td>Self-study, research project hand in!</td>
<td>JLR</td>
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Important information: In instances where a test or other deadline is missed a valid original doctor’s certificate is required within five days following deadline. The certificate must be handed in to Prof Le Roux and a sick test (oral or written format) will normally be taken one week (7 days) after the original test date. No time extensions will be allowed for handing in practical reports and reports handed in late will not be marked.

All tests and reports will be handed back to the students within 14 days after submission, unless otherwise communicated to the students. If you are unable to make scheduled deadlines you should contact Prof Le Roux well in advance to make alternative arrangements. In special circumstances (e.g. participation in provincial or national sporting events) a letter is required from the sporting body. In these instances, granting of permission to miss tests or deadlines is at the discretion of the course coordinator, and not automatic.