Honours projects that use **spatial information tools and data** (remote sensing, geographic information systems, spatial analysis and modelling) are available for students in science, natural resource management, environmental science, geography, earth science and agriculture. They cover a wide range of applications and settings, including terrestrial and marine ecology, land assessment and management and earth science. Students should have completed a GIS and/or Remote Sensing, but specific projects can be defined to suit different interests and skill levels.

Several of the projects listed below are conducted in collaboration with government agencies and outside partners such as Department of Water, Land and Biodiversity Conservation, Department of Environment and Heritage and regional Natural Resource Management groups. In addition, there is scope for projects that involve supervisors from other Disciplines.

**Software and equipment available for use in projects include:**

- ERDAS Imagine, ER Mapper, ENVI, IDL, ArcGIS, field computer
- Visible-shortwave infrared spectroradiometer.
- Differential GPS
- GIS & image data: SA Soils, topography, land use, extensive archived Landsat, ASTER and MODIS imagery & specific study site/project imagery & data.

**AREAS OF RESEARCH**

**Vegetation and wildlife habitats and biodiversity**

1. **Wombats from space.**
   
   Supervisors: Dr. Bertram Ostendorf, Assoc Prof Megan Lewis
   
   email: Bertram.Ostendorf@adelaide.edu.au, megan.lewis@adelaide.edu.au
   
   Two students can be involved in this research area at the interface between native animal conservation and agricultural management. In the past, there has been conflict between farmers and environmental protection of wombats. Detailed population estimates of Southern Hairy-nosed Wombats are needed. This project aims at finding a relationship between warren number/size/location and wombat population using remotely sensed information as Wombat warrens can readily be identified on satellite imagery.

2. **Southern Emu Wren habitat assessment and prediction.**
   
   Supervisors: Assoc Prof Megan Lewis, Dr. Bertram Ostendorf
   
   email: megan.lewis@adelaide.edu.au, Bertram.Ostendorf@adelaide.edu.au
   
   The Southern Emu-wren is a critically endangered species and on-ground actions are required to help ensure the survival of the species.

   Habitat for this important species will be documented using imagery and spatial data and predictive models used to identify potential habitat areas on Fleurieu Peninsula. The project will
involve field sampling and spatial data analysis and is supported by the Conservation Council of SA. A scholarship is available.

Further projects may be developed to find optimal locations for reintroduction of the emu-wren in the dryer parts of South Australia in collaboration with DEH. Current habitat in Hattah-Kukne National Park (Victoria) will be compared with locations in Billiat using Laser Altimetry and high resolution aerial photography.

3. **Mapping biodiversity stress with satellite imagery**  
Supervisors: Dr Ken Clarke and Assoc Prof Megan Lewis  
Email: kenneth.clarke@adelaide.edu.au

It is difficult to monitor biodiversity over extensive areas with field surveys. Broad-scale satellite imagery may be used to develop surrogates for biodiversity that can be applied to predict biodiversity “hotspots” and threats in sensitive areas. This project uses newly available MODIS image products to develop and test image indices for monitoring biodiversity in arid areas, building on work recently completed by the Spatial Information Group. Two large datasets of field biodiversity measurements have already been processed into a form suitable for validating this remote sensing work.

4. **Vegetation structure and habitat mapping.**  
Supervisors: Assoc Prof Megan Lewis, Dr. Bertram Ostendorf  
email: megan.lewis@adelaide.edu.au, Bertram.Ostendorf@adelaide.edu.au

Several projects are available using data from a LIDAR (laser scanning) instrument to provide information about vertical structure in vegetation stands, combined with data from advanced hyperspectral remote sensing about species composition and health. The LIDAR provides high-resolution terrain data, including vegetation height and density profiles, while optical remote sensing provides information about vegetation type, cover and condition. We are interested in combining the two technologies for habitat assessment in several regions: Monarto native vegetation and revegetation stands, mound springs in northern arid South Australia, bushfire affected areas near Mt. Bold, and the River Murray floodplain. Projects involve advanced image analysis combined with field work to validate the data.

5. **Native vegetation conservation value assessment.**  
Supervisors: Assoc Prof Megan Lewis and Dr Patrick O’Connor  
email: megan.lewis@adelaide.edu.au

We need objective information on the conservation status of remnant vegetation in modified landscapes in order to prioritise conservation funds and effort and to assess the effectiveness of management over time. Current methods rely on field survey, often by trained experts, and are expensive and time consuming to conduct. This project will use remote sensing to discriminate vegetation composition and condition, and develop methodologies for linking field data with spectral information. Extensive field data on vegetation remnants in the Mt. Lofty Ranges are available for this project, although additional field work may be required to validate results.

6. **Koonamore Vegetation records enhanced with GIS**  
Supervisor: Assoc Prof Megan Lewis, Dr. Bertram Ostendorf,  
email: megan.lewis@adelaide.edu.au, Bertram.Ostendorf@adelaide.edu.au

Vegetation in permanent quadrats at Koonamore Vegetation Reserve has been monitored for over 80 years. The data is a unique and highly valuable record of vegetation change in the SA
This project will use GIS techniques to display, visualise and analyse time sequences of these vegetation records to help understand the dynamics of plant populations in relation to climate and grazing. Exciting techniques such as 3D visualisation and time-movies will be used.

7. **Biomass and topographic relationships in tropical rainforest.**
   Supervisors: Dr. Bertram Ostendorf, Assoc Prof Megan Lewis
   email: Bertram.Ostendorf@adelaide.edu.au, megan.lewis@adelaide.edu.au
   The project examines relationships between tropical rainforest biomass and topography, and rainforest boundaries in northern Queensland. GIS data is available for the project; application of ecological models within a GIS framework is required to investigate environmental relationships. This project will liaise with CSIRO and may include a visit of the Tropical Forest Research Centre, Atherton.

8. **Understanding spatial rainfall pattern using Rainfall Radar.**
   Supervisors: Dr. Bertram Ostendorf, Assoc Prof Megan Lewis
   email: Bertram.Ostendorf@adelaide.edu.au, megan.lewis@adelaide.edu.au
   Rainfall is possibly the most critical environmental variable for most environmental research ranging from biodiversity and rare species habitat to the economic viability of agricultural regions. But the traditional rainfall gauge network is too sparse to identify the detail in spatial rainfall pattern that is necessary for many environmental and agricultural studies. Spatial radar rainfall data (a map every 10 minutes!) may help. This challenging project will be conducted in close collaboration with the Bureau of Meteorology an will make you one of the few people who know how to use this data.

9. **Fire in Desert Australia.**
   Supervisors: Dr. Bertram Ostendorf, Assoc Prof Megan Lewis
   email: Bertram.Ostendorf@adelaide.edu.au, megan.lewis@adelaide.edu.au
   These projects aim at analysing the fire regime of desert Australia. How to manage fire to maintain desert biodiversity is under strong debate. One project will examine the relationships of plant growth, climate and soil conditions prior to large fires in arid Australia, using satellite images and weather records in order to get a clear idea of the causes of such fires. A second project focuses on the patchiness of such large fires and uses satellite imagery to assess the proportion of burned areas within the region of these large fires. The idea is that an understanding of the patchiness may lead to important management decisions because the patchiness of fire has strong implications for fauna survival and biodiversity conservation.

**Marine systems**

1. **Land-coast interactions.**
   Supervisors: Dr. Bertram Ostendorf, Assoc Prof Megan Lewis
   email: Bertram.Ostendorf@adelaide.edu.au, megan.lewis@adelaide.edu.au
   The following projects aim at understanding the linkages between land processes and marine biodiversity. Marine Protected Areas (MPAs) are under increasing pressure from many users. Little attention has been paid to agriculture as a potential threat. Several projects need to be conducted that try to establish a link between the quality of marine biodiversity and terrestrial ecosystem processes. The first project will estimate the nutrient loadings of surface and subsurface water flow from agricultural land use and soil property data. The second project will establish the utility of remote sensing and GIS for assessing nutrient land-based nutrient inputs.
into coastal waters by evaluating how patches of high chlorophyll concentrations develop and dissipate.

2. **Marine Protected Area design.**
Supervisors: Dr. Bertram Ostendorf, Dr Megan Lewis
email: Bertram.Ostendorf@adelaide.edu.au, megan.lewis@adelaide.edu.au
The Government of South Australia is investing considerable resources into the design of marine protected areas in the coastal waters of the state. We have developed a new spatial decision support system to assist the Department for Environment and Heritage (DEH) with its MPA planning. This system, called OSS, is a simple, fully functional tool that sits within a GIS and rapidly processes and transfers spatial marine data to and from a mathematical optimiser. You will be working closely with personnel in DEH and, if you're lucky, may catch some fish during your honours.

**Land evaluation and monitoring; Earth science**

1. **New technologies for soil mapping.**
Supervisor: Assoc Prof Megan Lewis and Dr Bertram Ostendorf
email: megan.lewis@adelaide.edu.au and bertram.ostendorf@adelaide.edu.au
New remote sensing technologies (gamma radiometrics, electromagnetics and hyperspectral imagery) are being explored to enhance our understanding of soil variation in the landscape. This project uses comprehensive soil core data to critically test how soil properties vary in space, and several forms of remote sensing and topographic data to enhance mapping of soil properties and soil types. The project may involve collection and analysis of soil data to validate predictive maps.

2. **Monitoring erosion risk in SA croplands.**
Supervisor: Assoc Prof Megan Lewis and Dr Bertram Ostendorf
email: megan.lewis@adelaide.edu.au, Bertram.Ostendorf@adelaide.edu.au
To assess the risk of erosion in SA agricultural lands extensive surveys are conducted by trained observers in vehicle transects (windscreen surveys). This project evaluates satellite remote sensing as a way of improving the mapping and monitoring land condition across the state, to give more reliable and cost-efficient information. The project will involve analysis of MODIS images from different dates and opportunity for field survey work in conjunction with Dept. Water Land and Biodiversity Conservation staff.

**Environmental decision support systems**

1. **Precision agriculture and satellite imagery.**
Supervisors: Dr. Bertram Ostendorf, Assoc Prof Megan Lewis
email: Bertram.Ostendorf@adelaide.edu.au, megan.lewis@adelaide.edu.au
Precision agriculture is a rapidly expanding technology. Very detailed yield data have been collected for a wide range of crops. Yield varies substantially across paddocks will allow us to lessen environmental impact if fertiliser and pesticide applications can be reduced. This project will help farmers and catchment groups to manage environmental and economic sustainability and increase biodiversity in agricultural systems. The project will aim to identifying a network of areas that are underperforming and produce little loss if taken out of production, yet potentially constitute an important network for biological conservation.
2. **Providing data layers for land use planning in developing countries.**
Supervisors: Dr. Bertram Ostendorf, Assoc Prof Megan Lewis
Email: Bertram.Ostendorf@adelaide.edu.au, megan.lewis@adelaide.edu.au
Land evaluation and land use planning is an important issue in many developing countries. Yet very often critical data for regional management is missing. Detailed soil maps often exist only for limited areas but expansion of urban and agricultural land is occurring at a fast rate. This project in collaboration with the Nong Lam University, Ho Chi Minh City, will develop means to improve existing soil maps by studying the relationships between topographic variables (using the US Space Shuttle Radar Mission data) and soil properties in order to improve soil mapping in tropical Vietnam.

3. **What are environmental and economic benefits of planting trees?**
Supervisors: Dr. Bertram Ostendorf, Trevor Hobbs
Email: Bertram.Ostendorf@adelaide.edu.au, hobbs.trevor@saugov.sa.gov.au
Planting trees in the cropping zone is seen as a possible solution to mitigate increasing atmospheric CO2 levels. In addition to income from carbon credits, a mixed land use provides a range of environmental benefits (salinity, biodiversity). But how much carbon is taken up given biophysical constraints (climate, soils) and how do the credits (carbon, environmental) compare with the farmers loss of cropping or grazing? This project is geared towards students with an interest in regional management and addresses the question under which conditions trees may be a viable alternative option for farmers and rural communities. The project will be in collaboration with DWLBC.

4. **Revealing the link between the price of a barrel of crude and a loaf of bread**
Supervisors: Dr Ken Clarke, Dr. Bertram Ostendorf
Email: Ken.Clarke@adelaide.edu.au, Bertram.Ostendorf@adelaide.edu.au
The cost of many of the commodities we take for granted is inextricably linked to the price of crude oil, and yet the consequence of rising crude prices are not clear. Product supply chains can be influenced by crude oil prices in a number of ways:
- being manufactured from petrochemicals (e.g. plastics and pharmaceuticals),
- requiring the consumption of petrol or diesel in sewing/harvesting or extracting (e.g. grain production, coal or other ore mining),
- requiring transportation at one or more parts of the supply chain (e.g. transportation of iron ore to a refining plant, transportation refined iron to a toaster manufacturing plant, and finally transportation of finished toasters to electronics stores).
There is a clear need to understand the impacts of rising crude oil prices better. A case study into a single commodity’s supply chain would begin to illuminate this important issue. Furthermore, this interdisciplinary project could naturally lead into more advanced studies generalising and modelling the impact of rising crude oil prices on larger portions of economies or industries.