Bachelor of Applied Science (Environmental Science) (SC01)

**Year offered:** 2011
**Admissions:** Yes
**CRICOS code:** 003502J
**Course duration (full-time):** 3 Years
**Course duration (part-time):** 6 Years
**Domestic Fees (indicative):** 2011: CSP $2,178 per semester (indicative)
**International Fees (indicative):** 2011: $12,250 (indicative) per semester
**Domestic Entry:** February and July
**International Entry:** February and July* (Conditions apply for July entry)

**QTAC code:** 418011
**Past rank cut-off:** 77
**Past OP cut-off:** 12
**OP Guarantee:** Yes
**Assumed knowledge:** English (4, SA) and Maths B (4, SA)

**Preparatory studies:** For information on acquiring assumed knowledge visit [http://www.qut.edu.au/assumed-knowledge](http://www.qut.edu.au/assumed-knowledge)

**Total credit points:** 288
**Standard credit points per full-time semester:** 48
**Standard credit points per part-time semester:** 24

**Course coordinator:** Dr Marion Bateson
**Discipline coordinator:** Dr Robin Thwaites
**Campus:** Gardens Point

**Career Outcomes**
Environmental scientists are continually needed in a wide variety of planning, management, monitoring and research careers. These roles are usually found in government departments and agencies, in local councils, in consultancy, and in industrial and mining companies. As an environmental science graduate you could be working in urban, rural or remote settings depending on your interests.

Graduates are equipped to assess resources, implement environmental impact programs, analyse and interpret environmental data and formulate contingency plans in a wide variety of areas. These include strategic land-use planning, waste disposal, pollution measurement and control, coastal protection, environmental impact of mining, tourism and urban development, rehabilitation and reforestation of degraded sites, ground water assessment and modelling, flood plain planning, erosion control, and marine science.

**Professional Recognition**
Graduates are eligible for membership of the Environment Institute of Australia and New Zealand (EIANZ) and a variety of other scientific societies, including the Soil Science Society of Australia (SSSA) and the Ecological Society of Australia (ESA).

**Recommended Study**
At least one of the sciences.

**Environmental Science Full-time Course Structure: First Semester Entry**

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<tr>
<th>Year 1, Semester 1</th>
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<tbody>
<tr>
<td>SCB110</td>
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<td>SCB111</td>
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<td>SCB112</td>
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**NOTE:**
1. Students with a Sound Achievement (4 semesters) in Maths A should enrol in MAB105.
2. Students with a Sound Achievement in Maths B and NOT wishing to major in Physics should enrol in MAB101.
3. Students with a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB121.
4. Students without a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB120.
5. Students without a Sound Achievement in Maths B or Maths A should consult with the course coordinator.

<table>
<thead>
<tr>
<th>Year 1, Semester 2 (Ecology and Environmental Science Pre-Major Strand)</th>
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<tr>
<td>NQB201</td>
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<td>NQB202</td>
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<td>SCB120</td>
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Plus either

| SCB121 | Chemistry 2 |
| Or |

| SCB122 | Cell and Molecular Biology |
| Or |
Environmental Science Full-time Course Structure: Mid-Year Entry

Mid-Year (July) Entry

FOR DOMESTIC STUDENTS: Due to the careful construction of scientific knowledge demanded in the SC01 degree, mid-year entry requires some compromises. There are two ways to construct a mid-year program:

1. Take foundation units and their follow-up units together, rather than in sequence. This will be very challenging, but will allow you to start second year units at the start of the next year. Please contact either the course coordinator or the discipline coordinator to devise a suitable program of study. Please note: as this option usually involves taking units from different levels concurrently, which may not timetable appropriately, in some cases it may not be possible to complete within the standard time frame.

2. Take three units per semester for the first three semesters, adding one semester to your degree completion time. This allows you to do your first year units in the correct sequence, at a slightly more leisurely pace, while still being officially a full-time student. You may enrol in a fourth unit (level 2 unit from your chosen major) provided you have the necessary pre-requisites. This is the recommended option.

FOR INTERNATIONAL STUDENTS: Mid-year entry is only available under certain circumstances. Please contact the Course Coordinator to discuss available midyear entry and advance standing options on a case by case basis.

Year 1, semester commencing July
- NQB201 Planet Earth
- SCB122 Cellular Basis of Life
- SCB120 Plant and Animal Physiology

NOTE: Students wishing to enrol in four units should add either MAB101 or MAB105 and contact the discipline coordinator for a modified program for subsequent semesters.

Year 2, semester commencing February
- NQB302 Earth Surface Systems
- SCB110 Science Concepts and Global Systems
  - Plus either
- MAB101 Statistical Data Analysis 1
  - Or
- MAB105 Preparatory Mathematics

Year 2, semester commencing July

Recommended Second Majors:
- Biodiversity, Ecology, Geoscience

* Elective Unit for all Majors except Forensic Science:
- SCB500 Industry Project

NOTE: SCB500 Industry Project is a unit that will be offered as an elective in all majors. This unit requires 84 credit points of Level 2 and/or 3 Science units, so it may only be taken at the completion of Year 2 in Summer or during Year 3.
NQB202  History of Life on Earth
SCB111  Chemistry 1
SCB123  Physical Science Applications

Environmental Science Part-time Course Structure

Students interested in undertaking this major part-time should consult the discipline coordinator.

UNIT SYNOPSES

MAB101 STATISTICAL DATA ANALYSIS 1
Experiments, observational studies, sampling, and polls; data and variables; framework for describing and manipulating probability; independence; Binomial and Normal distributions; population parameters and sample statistics; concepts of estimation and inference; standard error; confidence intervals for means and proportions; tests of hypotheses on means and proportions (one sample and two independent samples); inference using tables of counts; modelling relationships using regression analysis; model diagnosis; use of statistical software.
Antirequisites: BSB123, EFB101, MAB141, MAN101, MAB233  Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 is assumed knowledge.  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SUM-2, 2011 SEM-1 and 2011 SEM-2

MAB105 PREPARATORY MATHEMATICS
This unit is intended to cater for the needs of students whose background in mathematics is either weak or does not reach the equivalent of Senior Mathematics B. It is intended to provide the concepts and skills needed for successful study of those units within the university which assume a background equivalent to Senior Mathematics B. This unit is incompatible with a grade of High Achievement in Senior Mathematics B. The aim of this unit is to develop your mathematical skills in and understanding of algebra, functions and graphing, differential and integral calculus of one variable and to interpret and solve simple, real world problems using these skills.
Assumed knowledge: Year 10 Level 6 Mathematics is assumed knowledge  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SUM-2, 2011 SEM-1 and 2011 SEM-2

MAB120 ALGEBRA AND CALCULUS
This unit introduces and reviews the elementary concepts of function, calculus, matrices and vectors with special reference to applications in science, technology and business where appropriate. Topics covered include the algebra of complex numbers, elementary functions (polynomial, trigonometric, exponential and logarithmic) and their properties, differentiation and integration methods and principles, geometric and algebraic applications of vectors and the solution of linear systems using matrices.
Antirequisites: MAN120  Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 is assumed knowledge  Equivalents: MAB100, MAB125, MAB180  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SUM-2, 2011 SEM-1 and 2011 SUM

MAB121 CALCULUS AND DIFFERENTIAL EQUATIONS
Building upon the foundations established in MAB120 or Senior Maths C, this unit addresses the significant role of mathematical modelling using differential equations for the description and resolution of simple and complex problems relevant to real world situations. The formulation and solution of such problems is supported by appropriate advanced mathematical concepts used for function approximation, differentiation and integration. Undertaking this unit will allow you to develop your problem solving skills, especially in the context of advanced mathematical techniques applied to ordinary differential equations used to model real world problems. You will also gain a deeper understanding of the concepts of the derivative and the integral, and how these may be used in applied contexts.
Antirequisites: MAN121  Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB120 or MAB100 or MAB125  Equivalents: MAB111, MAB126, MAB131, MAB182  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SUM-2, 2011 SEM-1 and 2011 SEM-2

NQB201 PLANET EARTH
Earth Science impacts every aspect of modern life. Hence, the concepts of Earth Science are fundamental not only to the field of Geology, but also to Environmental Science, natural resource management, civil engineering and society at large. Planet Earth provides an introduction to Earth Science, including earth materials, geologic history, geological process at the Earth’s surface, and the complex interplay between the lithosphere, atmosphere, hydrosphere and biosphere through geologic time. Thus, Planet Earth is a foundation unit for further studies in Geology and Environmental Science and also serves as a broad introduction to the world we live on.
Equivalents: NRB230  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SUM-2
NQB202 HISTORY OF LIFE ON EARTH
This unit aims to provide you with an understanding of the processes of evolution and the changing environmental conditions through time that influenced the patterns of the evolution of life on this planet. The unit will provide you with practical experience in fossil plant and animal identification, classification and morphological interpretation. It will also enable you to apply palaeontological information to interpret the evolutionary history of higher taxa and the changing ancient depositional environments through time.
Equivalents: NRB240  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1

NQB302 EARTH SURFACE SYSTEMS
Understanding long and short term climate and environmental change is now recognised as crucial to the interpretation of our biotic, geomorphic and cultural landscapes. To fully understand environmental change it is important to recognise the interconnectedness between the atmosphere, hydrosphere, lithosphere, biosphere and humanity’s place within these spheres over various temporal and spatial scales. Developing knowledge of past and present climate change and landising processes helps to predict future process pathways for natural resource management, civil engineering, risk analysis, and impact assessment in the context of both natural and anthropogenic induced change.
Assumed knowledge: NQB201 is assumed knowledge.
Equivalents: NRB301  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1

NQB321 ECOLOGY
Ecology is the study of the factors that influence the distribution and abundance of organisms. Ecology deals with basic properties of individuals and the emergent properties of collections of individuals that form populations and the dynamics of these populations and their interactions with populations of other species. An understanding of basic ecological principles is central to managing species and ecosystems. This unit provides a broad theoretical background in the major concepts of plant and animal ecology. It serves the dual role of providing a thorough grounding in ecology for students from all faculties; and laying the conceptual foundation for later subjects in the ecology and environmental science.
Prerequisites: SCB110 or SCB112  Equivalents: NRB311  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1

NQB403 SOILS AND THE ENVIRONMENT
This unit will provide you with grounding in soil science (pedology) by emphasising pedological principles, their application to environmental soil analysis and management, and knowledge of ecosystem function of soil in a changing environment. This one of the most critical resources to consider within the context of climate change and is an essential component of environmental scientific studies. It also complements and provides a basis for further biogeo scientific studies in the SC01 degree. Your knowledge of past and present soil processes will help you to predict process pathways and outcomes for the purposes of environmental planning and management, risk analysis, and impact assessment involving soils. It also contributes to your understanding of field survey and interpretation of soil phenomena in ecological, geological and environmental contexts.
Prerequisites: NQB302 or NRB301 or (ENB272 and ENB274)  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

NQB421 EXPERIMENTAL DESIGN
This unit deals with the theory and practice of experimental design and the quantitative approaches used for the investigation of ecological and environmental questions discussed in the prerequisite unit Ecology and developed in subsequent units in the ecology and environmental science majors.
The aims of this unit are to to provide an introduction to the logic of experimentation and experimental design; build a practical extension on the theoretical basis of statistics obtained in other units using experimental situations commonly met in ecology and environmental science; and apply methods used to quantify the ecological attributes of populations and communities in experimental field situations.
Prerequisites: MAB101 or MAB104 or MAB105 , and NQB321 or NRB311  Equivalents: NRB412  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

NQB501 ENVIRONMENTAL MODELLING
The capacity for management of complex environmental problems such as climate change, now and in the future, will rely on the capacity of environmental managers to create, interpret and critically analyse models of environmental systems. Mathematical model building promotes the capacity to understand the interdependent relationships that characterise environmental systems and also provides a quantitative foundation for informed environmental management.
Prerequisites: NQB412 or NQB421  Assumed knowledge: 48 credit points of second level science units is assumed knowledge.  Equivalents: NRB500  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1

NQB502 FIELD METHODS IN NATURAL RESOURCE SCIENCES
Field experience is an essential part of the professional training of geologists, environmental scientists, ecologists, and natural resource specialists in general. The theory and practice of methods to interpret, measure, map, and monitor important natural resource features and characteristics are essential to the study of geological, ecological and environmental systems. Methods of survey, mapping and interpretation are necessary skills for resource assessment, geo-exploration, environmental impact assessment, land evaluation, baseline studies, and ecological investigations. There are varying emphases on these outcomes depending on the type of field survey you undertake in this unit.

**Prerequisites:** (NQB321 or NQB411) and (NQB302 or NQB412)

**Assumed knowledge:** 36 credit points of second level science units in selected major is assumed knowledge. NQB302 and NQB403 for Env Sc, NQB321 for Ecol, NQB411 and NQB412 for Geosc

**Equivalents:**

NQB601 Credit points: 12 Contact hours: 4 per week
Campus: Gardens Point Teaching period: 2011 SEM-1

**NQB503 SPATIAL ANALYSIS OF ENVIRONMENTAL SYSTEMS**

TBA

**Equivalents:** NRB501 Credit points: 12 Contact hours: 4 per week
Campus: Gardens Point Teaching period: 2011 SEM-1

**NQB601 SUSTAINABLE ENVIRONMENTAL MANAGEMENT**

This unit provides background and details on global sustainable management issues and practices with a focus on Australia. It is therefore an important unit of study for any graduate wishing to pursue a career in environmental science who shares an abiding interest in the state and sustainable management of our planet. The unit compliments other advanced units dealing with environmental science and its practice. The aim of this unit is to gain deeper understanding of a variety of current issues in environmental management; their multi-disciplinary nature, the science behind them, and the ways of achieving sustainable environmental management in scientific and practicable ways.

**Assumed knowledge:** 48 credit points of second level science units is assumed knowledge.

**Equivalents:**

NRB600 Credit points: 12 Contact hours: 4 per week
Campus: Gardens Point Teaching period: 2011 SEM-2

**NQB602 ENVIRONMENTAL CHEMISTRY**

Focusing on fundamental environmental principles, this unit provides essential material for students majoring or co-majoring in any of several disciplines: earth science, environmental science, ecology, biodiversity and chemistry. Material covered includes: basic chemical principles underlying global, regional and local environmental processes; behaviour of natural and synthetic chemical species in the environment and biota (basic toxicology); and basic concepts in applied biogeochemistry, bioremediation and bioleaching. The unit also fosters development of practical and theoretical environmental monitoring skills using physicochemical parameters. Such monitoring data is used to promote informed environmental management through facilitation of scientific hypotheses testing about the environment; supply of data for model validation; testing compliance with regulations and guidelines; and providing data for environmental impact and risk assessment.

**Prerequisites:** PCB140 or PCB142 or SCB111 or SCB121

**Assumed knowledge:** 72 credit points of Science and/or Health units is assumed knowledge

**Equivalents:**

NRB440 Credit points: 12 Contact hours: 4 per week
Campus: Gardens Point Teaching period: 2011 SEM-2

**NQB614 GROUNDWATER SYSTEMS**

This unit focuses on the origin, occurrence and movement of groundwater; aquifer properties; chemistry and quality of groundwater; exploration methods for groundwater; drilling methods and well testing equipment; assessment of groundwater problems, both supply and quality; and introduction to modelling of groundwater systems. Groundwater resources of Australia are covered and current issues. Lectures are supported by desktop exercises. Students will obtain practical experience with pump tests and computer modelling. There is interaction with government and private sector hydrogeologists, and a field site visit for hands-on well testing.

**Prerequisites:** NQB302 or NRB301 or ENB383

**Equivalents:**

NRB633 Credit points: 12 Contact hours: 4 per week
Campus: Gardens Point Teaching period: 2011 SEM-2

**NQB623 ECOLOGICAL SYSTEMS**

The science of ecology examines the distribution and abundance of organisms at a number of organisational levels from individuals to landscapes. At each of these levels there are separate and distinct attributes that require investigation and explanation. One important level of organisation is the ecosystem. An essential component of ecological studies is to examine these ecological systems and how they are shaped by the interaction between their constituent species and the physical environment. This unit builds on aspects animal and plant diversity and ecology covered in previous units to examine how the interrelationships between key physical, ecological, biological and geological processes shape ecological systems. The aim of this unit is to develop an understanding of the structure and function of terrestrial and aquatic ecosystems, and especially the processes that have shaped Australia's major ecological systems.

**Prerequisites:** NQB321 or NRB311

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point Teaching period: 2011 SEM-2
SCB110 SCIENCE CONCEPTS AND GLOBAL SYSTEMS
You will undertake interdisciplinary study of the physical, geological and biological concepts relating to the origins of life; from the creation of matter and planets, to the emergence of life in all its complexity, culminating in evolution of earth ecosystems. Human influences, overlaid upon earth’s complex systems, will be examined as to their type, extent, and impact. In counterpoint, you will explore the breadth of philosophical developments underlying our search for knowledge; fundamental thoughts and ideas that span the last 2,500 years of human history. Ultimately, these concepts evolved through the development of a scientific method and we explore its workings in relation to the ongoing enterprise of human understanding.

Credit points: 12  Contact hours: 4.5 per week  
Campus: Gardens Point  Teaching period: 2011 SEM-1 and 2011 SEM-2

SCB111 CHEMISTRY 1
Chemistry is the central science. It affects society as well as the individual. It is the language and principal tool of the physical sciences, the biological sciences, the health sciences and the agricultural and earth sciences. A basic knowledge of chemistry is essential to all students in these areas. Knowledge of chemistry allows a better understanding of the human body and of the environment in which we live. The aim of this unit is to introduce you to the basic concepts of general, inorganic, analytical and physical chemistry.

Antirequisites: SCB113  Credit points: 12  Contact hours: 4.5 per week  
Campus: Gardens Point  Teaching period: 2011 SEM-1 and 2011 SEM-2

SCB112 CELLULAR BASIS OF LIFE
Scientists from all disciplines need an appreciation and a broad overview of the characteristics and functioning of the five groups of living organisms (bacteria, protists, fungi, plants and animals), and their interactions with the inanimate world. SCB112 Cellular Basis of Life is a first semester unit that is essential for many students undertaking courses requiring biological knowledge. Through integrated lecture and laboratory classes, this unit provides you with a foundation for later more advanced studies in your course or major (eg such as medical science, biomedical science, pharmacy, optometry, biochemistry, biotechnology, microbiology, geosciences, ecology, business and education among others). The aim of this unit is to introduce you to the wide diversity of living organisms while emphasising the unity of life processes at the cellular, biochemical and biophysical levels.

Antirequisites: LQB182, LSB118  Credit points: 12  Contact hours: 4 per week  
Campus: Gardens Point  Teaching period: 2011 SEM-1 and 2011 SEM-2

SCB120 PLANT AND ANIMAL PHYSIOLOGY
Regardless of which area of biology you decide to specialise in, you will need to understand the complex interactions between cells, tissues, organs and organ systems that comprise multi-cellular organisms. Although many living processes can be explained at the levels of biochemistry, biophysics and cell biology, a true understanding of complex, multicellular organisms requires integration of knowledge drawn from all of these areas, combined with the more complex physiological and structural levels you will learn about in this unit. The knowledge gained in this and other first level units provides you with the conceptual framework necessary to understand processes occurring from the cellular to the whole organism level and to higher levels of organisation.

Prerequisites: SCB112  Equivalents: NRB270  Credit points: 12  Contact hours: 4.5 per week  
Campus: Gardens Point  Teaching period: 2011 SEM-2

SCB121 CHEMISTRY 2
Chemistry is the central science. This is a unit of fundamental importance as it covers the background and general principles that underpin understanding in many science and health related disciplines. In this unit you will be introduced to fundamental aspects of chemistry including the nature of matter, atoms, molecules and ions. From this basis you will develop an understanding of the electronic structure of atoms, chemical bonding and molecular structure as well as the fundamentals of organic chemistry (often described as the chemistry of life). The aims of this unit are to generate an understanding of the importance of chemical bonding and molecular structure and how these factors effect the properties of organic and bioinorganic molecules; and to allow recognition of, and provide an understanding of, the nature of organic functional groups and their respective reactivity.

Prerequisites: (SCB111 or PCB142)  SCB111 can be studied in the same teaching period  Antirequisites: PQB105 and SCB113  Credit points: 12  Contact hours: 4.5 per week  
Campus: Gardens Point  Teaching period: 2011 SEM-1 and 2011 SEM-2

SCB122 CELL AND MOLECULAR BIOLOGY
SCB122 Cell and Molecular Biology 1 equips students with a comprehensive understanding of the molecular basis of the cell. This unit expands on the basic principles and concepts relating to cell structure, function, perpetuation and specialisation introduced in SCB112 and introduces students to fundamental molecular mechanisms central to the organisation of the cell. Students will be shown how macromolecular interactions are crucial to information flow and heredity. Students are taught the relationships between chromosomes, genes and cellular function and ultimately how these may determine an organism's phenotype. This
unit underpins cell biology and molecular biology units that are offered in second year Life Science units. SCB122 is also ideal for interfaculty students (eg Education, Business, Arts) who will undertake no further life science studies. **Prerequisites:** SCB112. SCB112 can be studied in the same teaching period. **Antirequisites:** LSB238  **Credit points:** 12  **Contact hours:** 4.5 per week  **Campus:** Gardens Point  **Teaching period:** 2011 SEM-2

SCB123 PHYSICAL SCIENCE APPLICATIONS

Physics principles underpin all of the sciences and ‘new technologies’. This unit adopts an investigative team-based approach to provide students with an appreciation of fundamental concepts in physical science, together with experience in the application of these concepts to a range of ‘real world’ problems. The unit should be taken in the first year of study as the fundamental principles introduced here will be built upon in later units in the context of each science student's major discipline area. Employers in cutting-edge industries expect science graduates to have effective strategies for problem solving, skills for collaborative work and scientific communication and research skills. This unit aims to develop these skills by applying the fundamental concepts of physical science to problems in a team environment.  **Credit points:** 12  **Contact hours:** 4.5 per week  **Campus:** Gardens Point  **Teaching period:** 2011 SEM-2

SCB500 INDUSTRY PROJECT

In this unit students will apply scientific methods and quantitative techniques to real work issues. Students will develop an appropriate plan for analysing and resolving an industry issue under the guidance of both a QUT supervisor and an associate supervisor from an industry partner. At the end of the unit students will present both an oral seminar and a written report.  **Credit points:** 12  **Contact hours:** 52  **Campus:** Gardens Point  **Teaching period:** 2011 SEM-1, 2011 SEM-2 and 2011 SUM