



# International Tundra Experiment

## Update-October 1992 (No. 3)

### ITEX on the move

During this past summer, ITEX has developed tremendously in various directions. For the first time, the central temperature enhancement experiment is being implemented, and the different kinds of suggested ITEX devices are popping up at field sites throughout the Arctic. Since the first preliminary version of the ITEX Manual was circulated in May, many field stations have entered the common monitoring program. I hope you are encouraged by the short reports from these field parties in this newsletter.

The secretariat at the Danish Polar Center (DPC, see Appendix on p. 6) has been operating since late spring, which of course is important for any further development of the program. However, even though it is inexpensive, the administration requires funding. As far as I know, only two of the participant countries have so far contributed shares of the estimated annual total requirement of US\$ 5,000 from their respective national MAB boards ...

Recently, ITEX has approached the Scientific Steering Committee of GCTE (Global Change & Terrestrial Ecosystems), a core project of the IGBP (the International Geosphere-Biosphere Programme), in order to become formally linked to the GCTE Operational Plan. Decisions will be taken later in the autumn.

With all the new experiences from the past summer's activities in the field, we are now able to thoroughly revise the ITEX Manual. Updating and customizing the manual is going to be a major issue at the Fourth ITEX Workshop at the University of Oulu, Finland, 9-11 December, 1992. During the workshop, which is going to be crucial to the progress of ITEX, we must also consider data acquisition, analysis, and publication, and the development of theoretical models for the Arctic based upon empirical ITEX data. This last subject would be much facilitated with an affiliation to IGBP-GCTE including their Long-term Ecological Modelling Activity (LEMA). Someone suggested that ITEX was the acronym for "International Tundra Experiences", and this is of course what we are going to share

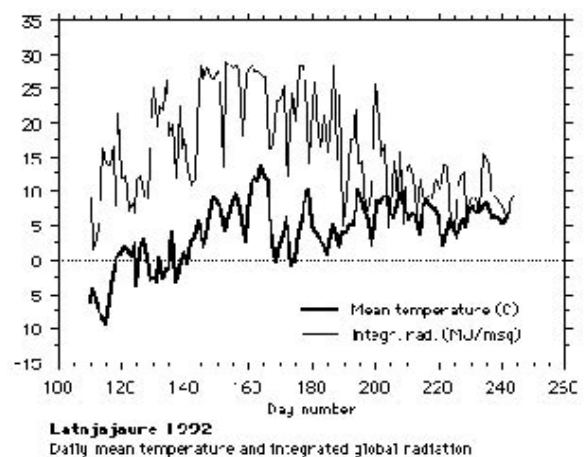
in pleasant circumstances at the Oulu workshop. I look forward to see all the ITEXers at this promising meeting!

*Ulf Molau, chair*

### IPCC Assessment Report

An updated assessment report from IPCC (the International Panel on Climate Change of United Nations Environment Programme, UNEP) was published in June, 1992. This report, entitled "Climate Change: The IPCC 1990 and 1992 Assessments", will become a standard work of reference, providing the scenario and background data for ITEX and all other global projects focusing on climate change. An effective doubling of CO<sub>2</sub> in the atmosphere is expected to occur between now and 2025 to 2050. The various present GCMs (General Circulation Models) imply a consequent increase in the global mean temperature in the range of 1.5 to 4.5 degrees. This warming is however anticipated to be rather unequally distributed on a global scale. The estimated increase of global mean per decade is 0.3 degrees under the IPCC Business-as-Usual scenario, but the warming is believed to be twice as rapid in the Arctic, i.e., in the range of 0.6 degrees per decade.

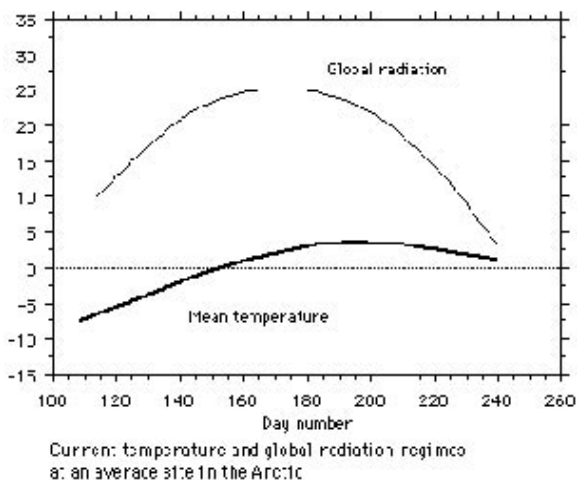
For terrestrial ecosystems in the Arctic, a mean warming of this magnitude will have a huge impact on the organisms. Let us consider an example, and take a look at some 1992 data from the climate station at the Latnjaure ITEX site in N Sweden:



continued ...

Note that, despite the unusually warm period in late May and early June (day nos. 144–162), both curves are rather smooth, with the radiation maximum located about 40 days ahead of the temperature maximum. In May the mean temperatures are just below zero, whilst radiation approaches the annual maximum. At this time of the year, there is a tremendous solar energy potential for plant growth, which is still not utilized due to below-freezing temperatures. There is no such radiation potential at the end of the summer (September). If we hypothetically increase the mean temperature by 3 degrees (50 year scenario) at an average arctic site, the sketch below indicates that we would expect a prolongation of the growing season with 20–30 %, and most of this increase would be in May, when radiation energy supply for plant growth is close to optimal. Among other consequences, drastic changes in the composition of the seed pool are to be expected in the Arctic.

Ulf Molau



## Progress to Date

Fundamental progress has been made in most national ITEX projects during the summer of 1992. The following summarizes highlights of current activities of ITEX. Thanks are due to all reporting ITEX participants. More detailed reports will be presented at the Fourth ITEX Workshop in Finland.

**Canada:** All Canadian field parties report an unusually short and cold summer, caused by stratospheric dust from the Mt. Pinatubo eruption. (This "Pinatubo Effect" was very obvious also in the ITEX sites in Greenland and northern Fennoscandia)

Sylvia Edlund (Geological Survey, Ottawa) has increased ITEX field work at Hot Weather Creek, Ellesmere Island (80°N). For some of the plant species there are now five-year phenological records. Some open-top greenhouses were installed during 1992 in populations of *Salix arctica*. Besides of this species, *Cassiope tetragona*, *Dryas integrifolia*, *Saxifraga oppositifolia*, *Ranunculus nivalis*, *Oxyria digyna*, *Carex stans*, and *Epilobium latifolium* were subject to intense monitoring in permanently marked clones or plots. ITEX field work at Hot Weather Creek is part of an ongoing program of the Geological Survey of Canada, monitoring the terrain response to climatic change. The site has a full-service automatic climate station since 1988, and there are also manual weather observation records from the vegetation seasons.

Greg Henry (University of British Columbia, Vancouver) reports enormous ITEX progress from another part of Ellesmere Island, the Alexandra Fiord (79°N). Two sites were established in early summer 1992, one in the coastal lowland and one in an arctic semi-desert plateau at 600 m altitude. This vigorous program will continue for 3–4 years, and has substantial funding for the entire period from the Natural Sciences and Engineering Research Council of Canada (NSERC). One of Greg's Ph.D. students, Michael Jones, and Ester Levesque (University of Toronto) are essential members of the Alexandra Fiord team, but the activities also includes graduate students and field assistants. The abandoned base camp of the Royal Canadian Mounted Police has been put at their disposal. There are now four continuously operating automatic climate stations, all using Campbell Scientific CR10 dataloggers, and meteorological data is available for several years. A number of hexagonal fiber-glass open-top greenhouses were erected in 1992. Monitoring and experimentation was concentrated primarily on *Salix arctica* (Michael Jones) and *Cassiope tetragona* (Jill Johnstone, M.Sc. student). Other species monitored in the lowland site include *Eriophorum angustifolium*, *Papaver*, *Oxyria*, *Luzula arctica*, *Carex fuliginosa*, *Arctagrostis latifolia*, *Dryas integrifolia*, and *Silene acaulis*. At the upland semi-desert site, monitoring of permanently tagged individuals include *Saxifraga oppositifolia*, *Salix arctica*, *Dryas integrifolia*, and *Luzula arctica*.

Some of the open-top chambers were also sent to Larry Bliss at the old IBP site in Truelove Lowland, Devon Island, the third of Canada's

ITEX sites.

Josef Svoboda reports that he established a fourth ITEX site at Baker Lake (64°N), some 300 km west of Hudson Bay. Here thirty plants each of *Dryas integrifolia*, *Cassiope tetragona*, and *Saxifraga tricuspidata* were tagged and monitored. One of the reasons to establish an ITEX site at Baker Lake is that this locality has a first class meteorological station; climatic data over several decades are on record and available.

**Denmark:** Per Mølgaard continued his ITEX field work at the Arctic Station, Disko Island, W Greenland. Two species are subject to extensive monitoring and temperature manipulations, namely *Salix arctica* and *Papaver radicum*. A total of 48 sheltering devices, the so-called ITEX Corners, were established around target plants of these species and of *Pedicularis lanata*. Per also reports that the automatic weather station at the Arctic Station (installed in 1990) is running smoothly, the data being stored at the Dept. of Geography, University of Copenhagen. Temperature enhancement in the ITEX Corners was monitored by using thermocouples connected to a LICOR 1000 datalogger.

A second ITEX site in Greenland, at the new Zackenberg Ecological Research Station on the east coast (planned to be constructed in 1993), has been initiated, but no ITEX field work has been undertaken so far. The progress of the Zackenberg station is described in the ZERO News (two issues), available from the DPC.

**Finland:** The ITEX site at Kilpisjärvi in the northwest corner of Finland was greatly improved this year. The *Saxifraga oppositifolia* clones tagged in 1991 were monitored throughout the summer. Urban Nordenhäll from Sweden spent most of the summer at Kilpisjärvi on a Nordic interchange scholarship, where he established a monitoring and temperature enhancement program on *Salix herbacea* in a nearby late-melting snowbed area. A small climate station using a DeltaT datalogger was installed at the *Saxifraga* plot. The Finnish site is located in the Iso-Malla National Park (69°N) at an altitude of just above 600 m, a few kilometers NW of the Kilpisjärvi Biological Station. There are long monitoring records (up to twenty years!) of flowering and performance for a number of species in the area, among them *Dryas octopetala* and *Carex bigelowii*. Long-term climate data may be provided by a standard weather station a few kilometers further southeast.

**Iceland:** Inga Svala Jónsdóttir reports that the ITEX funding for 1992 provided by the Icelandic National Science Foundation was used to establish two ITEX sites. One is located in the Central Highland of Iceland near the meteorological station of Hveravellir at 600 m of altitude, the other one at roughly the same altitude on Mt. Skálafell close to Reykjavik. The Icelandic ITEX program is administered by the Agricultural Research Institute in Reykjavik. Monitoring in 1992 included the Group 1A species *Dryas octopetala*, *Salix arctica*, and *Saxifraga oppositifolia*, and 1B species *Carex bigelowii*, and transplants were also taken for common garden experiments.

**Norway:** Arve Elvebakk at the Institute of Biology and Geology, University of Tromsø, has succeeded Ann Marie Odasz (Tromsø) as the ITEX Norwegian country representative. Ann Marie is busy working on ITEX-related projects on grazing and genetic diversity in Svalbard, among other things. Arve Elvebakk has been conducting studies on microclimate and vegetation differentiation in Svalbard and E Greenland. He is much involved in the establishment of the new Botanical Garden of Tromsø, and together with Vladimiar Raszhivin (Leningrad) he has initiated a program for transplantation and common garden experimentation of Eurasian tundra plants. This ITEX-related research has an enormous potential for the genetical part of the ITEX program in the next few years.

Most ITEX and ITEX-related field work at the Norwegian site at Ny-Ålesund (Svalbard) is carried out by the British team (see under U.K.).

The Norwegian Institute for Nature Research (NINA) will be hosting an international conference on terrestrial ecosystems and global change in the Arctic in 1993. The meeting will take place at Oppdal near Trondheim during 23–27 August, and an international organization committee chaired by Walt Oechel, U.S.A., is presently working out the details.

**Russia:** Candidate ITEX sites have been recognized in Gydan, Lower Kolyma, and Anadyr, and Taimyr sites are to be identified shortly. The Kolyma site has two Campbell loggers (but no botanist yet).

A joint Russian-Swedish icebreaker-based expedition along the entire Russian arctic coast is planned for the summer of 1994, as a result of a collaboration between the Russian Academy of Sciences and the Swedish Royal Academy of Sci-

continued . . .

ences. ITEX participants from Russia and Sweden will be cruising with a Swedish vessel, and field work will be carried out in the coastland at even intervals along the route. Large-scale sampling of genetic variation in some of the selected ITEX species will help the realization of Level 2 of ITEX. Transplantation of plants to the Botanical Garden at Tromsø is part of the program (see under Norway). Other ITEX-related research programs for the expedition have been forwarded by Inga Svala Jónsdóttir (Lund, Sweden) and Sven Jonasson (Copenhagen, Denmark).

**Sweden:** The ITEX activities at the Latnjajaure Field Station (LFS) near Abisko in N Swedish Lapland increased during 1992. The climate station is now fully automatic and working on a year-round basis using a DeltaT datalogger, powered by solar panels and a wind generator. Monitoring of permanently marked plots or individuals of *Saxifraga oppositifolia* (initiated 1990), *Diapensia lapponica* (1990), *Cassiope tetragona* (1991), and *Oxyria digyna* (1991) was continued this season. New sets of permanently tagged individuals/plots for phenological monitoring were established for *Dryas octopetala*, *Eriophorum vaginatum*, *Ranunculus nivalis*, and *Salix herbacea*. Studies on the genetical variation within and among populations are conducted as Ph.D. thesis projects by Urban Nordenhäll (*Salix herbacea*) and Mikael Stenström ("*Sax opp*"). Temperature manipulation at Latnjajaure included a number of various devices, e.g., ITEX Corners, ground-cover fabric, standard glass cold-frames, dome-shaped ventilated plastic greenhouses, and "night cover" hessian tents. The latter design, with hessian covering at night to reduce negative radiation and enhance night temperatures, was initiated by Mats Havström and Terry Callaghan, since this temperature regime is closest to the predictions by GCMs. Mats Havström's own field work in his four-year project on temperature manipulations on *Cassiope tetragona* in Svalbard and the Abisko area was completed this past summer. The first paper, with results of great importance to ITEX, is in press (*Oikos*). A more detailed description of this project was provided in ITEX Update No. 2.

A continuation of ITEX at Latnjajaure has been guaranteed until at least 1995 thanks to a grant from the Swedish Natural Sciences Research Council (NFR). The datalogger and part of the climatic instruments were sponsored by the Kempe Foundation.

Implementation of a large-scale ITEX-related

project on plant sensitivity to UV-B was carried out at the Abisko Scientific Research Station by L.O. Björn, Mats Sonesson, and co-workers. A related workshop, "How will the alpine vegetation in Northern Scandinavia be affected by changed climate and ultraviolet-B radiation?" is arranged at the University of Lund 26–27 October 1992; the meeting is initiated and sponsored by the Swedish Environmental Protection Board (SNV).

**United Kingdom:** Terry Callaghan (Merlewood Research Station, Cumbria) informs that the U.K. has initiated two ITEX-related projects: a retrospective analysis of the growth and demography of three circumpolar plant species, and comparisons of plant sensitivity to environmental perturbations between a subarctic and a high arctic site. The retrospective analysis project is site-independent, and was initialized in 1990 by Terry Callaghan with the help of Mats Sonesson and Mats Havström (Sweden), Sven Jonasson (Denmark), and Alistair Headley (U.K.). The target species include one moss (*Hylocomium splendens*), a club-moss (*Huperzia selago*), and a dwarf-shrub (*Cassiope tetragona*). Material have been received from a great number of sites, and analyses are underway.

Environmental manipulations (temperature, precipitation, soil nutrients) were established in a subarctic dwarf shrub heath at Abisko, Sweden, and at a *Dryas*-dominated polar semi-desert site at Ny-Ålesund, Svalbard, during 1990, i.e., before ITEX methods had been developed. This collaborative program between the University of Manchester (John Lee et al.) and Merlewood is funded by the Natural Environment Research Council's (NERC) arctic terrestrial ecology special topic programme. The project is complementary to the environmental manipulations set up at three different sites by Havström, Callaghan, and Jonasson. A similar experiment has recently been established in the Swiss Alps by Christian Körner (Basel). With the addition of a site in the UK, planned for 1993, this gives a series of eight sites of varying environmental severity stretching from 41 to 79°N.

Richard Marsden, an M.Sc. student from the UCNW (Bangor), spent the entire vegetation season at the Latnjajaure Field Station (Sweden), where he carried out a general study on flowering process and micrometeorology.

**United States:** The most active ITEX site in the U.S. in 1992 was the Niwot Ridge LTER site, located in the Colorado Front Range at ca. 3500 m alt. The site is operated year-round through

the nearby Mountain Research Station of the University of Colorado. The climate station at Niwot Ridge was the prototype when developing the LTER (Long-Term Ecological Research) methods, and together with Latnjajaure the prototype for ITEX climate stations. Marilyn Walker (INSTAAR, Boulder, CO) reports that U.S. ITEX so far has no funding *per se*, but is carried out within the limits of other projects funded mainly by the National Science Foundation (NSF). Two open-top chambers (of the same kind as in Ellesmere Island) and a number of ITEX Corners were installed at Niwot Ridge this summer. Surface temperatures, and the growth and phenology of two species, *Acomastylis rossii* and *Bistorta bistortoides*, were monitored in these experiments as well as adjacent control plots. There are continuous records on phenology and development in these two species since 1983.

Giles Marion (Cold Regions Research & Engineering Laboratory [CRREL], Hanover, New Hampshire) also tested the open-top chamber at Point Barrow, Alaska, and students of Gus Shaver and Terry Chapin made ITEX-related observations at Toolik Lake, Alaska.

## The Fourth ITEX Workshop at Oulu

The Fourth ITEX Workshop will be held at the University of Oulu, Finland, **9-11 December 1992**. At this occasion, reports from the 1992 activities at ITEX sites will be presented, and there will be workgroups dealing with updating and revision of the ITEX Manual, sharing, comparison, and analysis of data, and compilation of ITEX progress reports. Please announce your desire to participate to Kari Laine, Botanical Gardens, University of Oulu, SF-905 70 Finland, tel. +358-81-553-1571, FAX +358-81-553-1584, preferably before November 10.

## Other Meetings and News

30 November - 3 December, 1992. The Role of Circumpolar Universities in Northern Development: The Third International Conference, Rovaniemi, Finland. Contact: Outi Snellman, University of Lapland, P.O. Box 122, SF-96101 Rovaniemi, Finland; FAX: +358-60-324207.

9 - 10 December, 1992. XV Symposium on Polar Biology: "New Technology for Marine Ecological Studies" and "Monitoring of Polar Ter-

restrial Ecosystems". National Institute of Polar Research, Tokyo, Japan. Contact: Secretariat, XV Symposium on Polar Biology, National Institute of Polar Research. 9-10, Kaga 1-chome, Itabashi-ku, Tokyo 173, Japan; FAX +813(3962)5743.

20 - 22 May, 1993. Environmental Information Management and Analysis: Ecosystem to Global Scales. Albuquerque, New Mexico. Contact: James Brunt, Dept. of Biology, Univ. of New Mexico, Albuquerque, New Mexico 87196, USA; FAX (505) 277-0304.

23 - 27 August, 1993. Global Change and Terrestrial Arctic Ecosystems: An International Conference. Trondheim, Norway. Contact: Jarle Holten, NINA, Tungasletta 2, N-7004 Trondheim, Norway; FAX +47-7-915-433.

4 - 8 October, 1993. International Symposium on the Ecological Effects of Arctic Airborne Contaminants. Reykjavik, Iceland. Contact: Ms. Debra Steward, Technical Resources, Inc., 3202 Tower Oaks Bd., Rockville, MD 20852, USA; FAX: (301) 468-2245.

22 - 25 March, 1994. Polar Tech '94. An international conference on development and commercial utilization of technologies in polar regions. Luleå, Sweden. Contact: Lena Allheim Karbin, CENTEK, Luleå University of Technology, S-951 87 Luleå, Sweden.

---

We will circulate the next update in spring 1993. Please mail project updates, prospects for funding, notes on methods and field experiences, upcoming events and meetings, description of field sites, etc., to the ITEX secretariat, Danish Polar Center, Hausergade 3, DK-1128 Copenhagen K, Denmark (FAX +45-33-134976), or directly to Ulf Molau, Dept. of Systematic Botany, Carl Skottsbergs Gata 22, S-413 19 Göteborg, Sweden (or FAX +46-31-823975)

Please share this bulletin with others and tell them that they may contact DPC for information. ITEX encourages all tundra specialists and students to become involved.

Appendix, see overleaf . . .

---

Other meetings, continued . . .

