International Tundra Experiment Update-April 1992 (No. 2)

ITEX at present

ITEX has made a lot of progress over the past several months. Since the first ITEX Update (December 1991) there have been two ITEX meeings, one at the Danish Polar Center in Copenhagen, Denmark, 5-6 February 1992, and one at Institute of Arctic and Alpine Research (INSTAAR), University of Colorado, Boulder, 10 March 1992 (see reports in this newsletter). The manuals for standardized ITEX monitoring, manipulations, and climate stations are under preparation, and a first version will be distributed before the start of the 1992 field season. A new Steering Committee was appointed at the Boulder meeting, and the editing of this newsletter is my first official undertaking as ITEX chairman. Furthermore, there is now a permanent central ITEX secretariat at the Danish Polar Center (DPC), kindly provided by the Danish authorities (see below).

Since ITEX is officially acknowledged as an MAB-NSN project, the administrative costs for the secretariat should be funded primarily as a joint venture of the MAB committees of those MAB-NSN countries that have the possibility to contribute financially. We estimate that about US$ 5,000 will be required annually by the DPC. US MAB has already transferred a share, and I urge all other country representatives to contact their respective MAB representatives to do the same (except Denmark, since they contribute with DPC and its services and staff).

Ulf Molau, chair

Report on the Second ITEX Workshop

The Second ITEX meeting was held at the Danish Polar Center, Copenhagen, on February 5 and 6, 1992. The meeting provided the opportunity of ITEX scientists to present results from their initial research and proposals for new work. Twenty four scientists from seven countries attended. Canada and Russia were unable to send representatives.

The major objectives of the meeting were to identify shared experiments and measurements and to discuss strategies for implementation, funding and coordination of ITEX. This report outlines the justification for ITEX and refines its definition as presented in the resolution of the December 9, 1990 founding meeting and presents the recommendations arising from the second meeting.

JUSTIFICATION, GOALS AND DESCRIPTION

1. High latitude and cold dominated ecosystems will be affected if the current predictions of global climate warming come to pass.

2. In order to predict the effects of climate warming on ecosystems, there is a need to assess the responses of individual system components, such as the primary producing plant populations. ITEX is a modest attempt to meet this need. It is not a monitoring program *per se*, but a program of experiments aimed towards improving the prediction of the effects of climate change.

3. The science of global change requires international cooperation and coordination. This is especially true for studies in the northern circumpolar lands. ITEX is a vehicle to foster international science and cooperation.

4. ITEX is a coordinated international program to assess the effects of temperature warming on arctic and alpine plant populations by using a network of northern, circumpolar sites which are beyond altitudinal and latitudinal treeline.

5. At each ITEX site a basic, common experiment will be performed. Other experiments will also be carried out but this may be done at only a few sites. Taken together, these experiments seek to quantify the potential ecological and evolutionary responses of representative tundra plant populations to the increased growing season temperatures predicted for northern regions.

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6. The overall objective of ITEX is to determine the potential of tundra plants to adjust to climate warming through acclimation or through adaptation (genetic change), and to partition the effect of climatic warming on key phenological, morphological, and physiological traits into environmental and genetic components.

7. It is intended that ITEX will function as a model program for other aspects of global change research. It is also intended that ITEX will emphasize the need for population level research in global change research programs. The ITEX sites and the ITEX approach will be useful for many aspects of global change research. Further, it is intended that ITEX, by virtue of the simplicity of its basic design and focus, can be implemented in a shorter time frame than larger total system studies.

RECOMMENDATIONS

1. **Participation** in ITEX requires the establishment of a standard temperature warming experiment and the measurement of standard climatic variables at a site. It also requires a commitment to data sharing and to allow access to a site and its biological resources.

2. **Encouragement** is given to scientists at each participating ITEX site to develop other more sophisticated experiments and observations. It will be necessary that studies to assess the genetic variability of plant populations and their genetic potential to respond to temperature warming be carried out at some sites or at central locations and laboratories. Studies of trace gas balance for the various experiments would also be fruitful at a few sites. Retrospective analysis of biological material containing historical proxy data, such as, annual growth markers, is also encouraged. Such material could be sent to a single laboratory for analysis.

3. **A central hypothesis** and/or a set of related, corollary or subsidiary hypotheses which will be tested by ITEX must be developed and be the focus of ITEX investigations.

4. **Central coordination** of the program is essential. The Danish Polar Center (DPC) has graciously offered to coordinate a newsletter and to explore the means of coordinating data sharing. Coordination will also include organizing annual meetings which should result in proceedings and synthesis volumes which, judging from the IBP (International Biological Programme) Tundra Biome experience from 1969 to 1974, will have long term value. Consideration of the DPC offer will be made at the March 10 meeting.

5. **Affiliation** of ITEX with other organizations should be made more concrete than it is at present. The Northern Sciences Network (NSN) of the UNESCO Man and the Biosphere (MAB) Programme recognizes ITEX as one of its programs. Formalization of ITEX as a MAB International Comparative Study will be explored by the NSN. This would result in support for coordination from the MAB Secretariat. Recognition, endorsement or even inclusion in larger organizations or programs, such as, IASC (International Arctic Science Committee) or IGBP (International Geosphere Biosphere Programme) should be explored. Such recognition will help obtain funding support for ITEX.

6. **Immediate review** must be made of relevant literature, of existing proven methods of manipulation and measurement and of available site data bases and documentation. Such reviews will prevent unnecessary duplication of past efforts and will result in better experimental methods and faster implementation of ITEX.

7. **Immediate attention** must be given to producing a precise "Methods Manual" for the basic common experimental design. This document should contain details of site selection, materials to be used, climate and response variables to be measured and measurement methods and standards. A first edition of this standard "Methods Manual" must be completed by the start of the 1992 northern field season.

8. **The following working groups** will report at the upcoming Boulder, Colorado meeting on March 10, 1992 and the above recommendations will be amended as necessary and ratified: Historical Data Bases; Temperature Enhancement Methods; Basic Response Variables and Species; and Basic Climate Measurements.

9. **Funding opportunities and strategies** should also be explored and discussed at the March 10 meeting.

Reported by Patrick J. Webber

Reported by Ulf Molau

Report on the Third ITEX Workshop

The Third ITEX meeting was arranged by the Institute of Arctic and Alpine Research (INSTAAR) on April 10, 1992, held in conjunction with the 22nd Arctic Workshop and the Classification of Circumpolar Arctic Vegetation Workshop at the University of Colorado at Boulder. Twenty four scientists from eleven countries attended the meeting.

The major objectives for the meeting were to resume the discussions from the Copenhagen meeting and to finalize a precise "Methods Manual". Short status reports from all nine ITEX countries were presented, and there were presentations of the results from the Copenhagen workgroups. Opportunities for cooperation with other project organisations in the Arctic were outlined by Mark Meier (ARCSS, ARCUS, IASC), Nick Flanders (MAB-NSN), and David Murray (Panarctic Flora Project).

Much effort was spent on the development of a comprehensive Methods Manual for all ITEX sites. At this meeting three workgroups were formed: Basic Questions and Hypothesis (Marilyn Walker, chair), Basic Temperature Enhancement Experiments (Giles Marion, chair), and Species Selection and Standard Measurements of Response Variables (Sylvia Edlund, chair). A manual for ITEX Climate Stations was presented by Ulf Molau and approved by the meeting. For descriptions of the various parts of the manual, see below.

The meeting decided to accept the generous offer from the Danish Polar Center in Copehagen to host the ITEX Secretariat. For details, see below.

Finally, a new Steering Committee for ITEX was appointed. Pat Webber, the creator of ITEX, retired from his position as interim chairman, but fortunately agreed to remain within the board. The present Steering Committee has the following constitution:

Ulf Molau, Sweden *chair*
Marilyn Walker, U.S.A. *co-chair*
Per Mølgaard, Denmark *co-ordinating secretary*
Patrick Webber, U.S.A. *member*
Josef Svoboda, Canada *member*

The ITEX Secretariat at DPC

The ITEX secretariat is now hosted by the Danish Polar Center (DPC), where one of its permanent staff members, Anne Morits Pedersen, will be in charge of all ITEX matters. The DPC will supply ITEX with all kinds of services, such as printing and distribution of newsletters, organizing meetings, publishing proceedings volumes and progress reports, filing data report forms, etc. The administrative costs for DPC (paper, mailing, printing, computing) will total about US$ 5,000 per year. This cost should be shared by the participating MAB-NSN countries via their national MAB committees. Thus, from now on you should send all report forms, questionnaires, newsletter contributions, etc., to:

ITEX Secretariat
Danish Polar Center
Hausergade 3
DK-1128 Copenhagen K
Denmark
phone: +45-33-158666
fax: +45-33-134976

ITEX manuals

Preparation of ITEX manuals were intiated at the Copenhagen meeting in February 1992, and the organization was partly revised at the Boulder meeting in March. The comprehensive ITEX manual will comprise the following parts:

Basic questions and hypotheses: Marilyn Walker (INSTAAR) chaired a workgroup at the Boulder meeting, and general statements of ITEX objectives and working hypotheses were formulated.

Background data collection: A questionnaire has been elaborated by Kari Laine (Oulu) and his Finnish collegues. This will provide the ITEX secretariat with a database for retrospective comparison at some sites, and it will enforce all national ITEX boards to clearly define their candidate ITEX sites. The questionnaire is distributed with this newsletter to ITEX representatives.

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Species and response variables: Sylvia Edlund (Ottawa) is completing the work of the group she chaired at the Boulder meeting on this part. The manual will include the final ITEX species selection list, species-specific recommendations for response variables and how to measure them, report forms, etc.

Temperature manipulation: A group chaired by Giles Marion (Hanover, New Hampshire) has continued working with standardizing the temperature enhancement experiments since the Boulder meeting. Several designs are being tested at the moment.

Transplantation and common gardens: Jim McGraw (Morgantown, West Virginia) has outlined a basic experiment, which he presented at Boulder.

Climate stations: A manual for standardized ITEX climate station was prepared after the Copenhagen meeting by Ulf Molau assisted by Halldor Thorgeirsson (Reykjavik). The manual, including report forms, was presented and accepted during the Boulder meeting.

Progress to Date

Considerable progress has been made in many national projects. The following summarizes highlights of current activities of ITEX.

Canada: Sylvia Edlund (Ottawa) will increase ITEX field work at Hot Weather Creek, Ellesmere Island, during 1992; this site has a well-equipped climate station corresponding to ITEX Level 2. She is monitoring several of the group 1A ITEX species, and will initiate temperature manipulations on some of them.

Other candidate ITEX sites were discussed during the first CANTEX meeting in Toronto on February 7, 1992, arranged by Josef Svoboda. There has also been a meeting (25 February) of Canadian ITEX representatives and Directors of the Atmospheric Environment Service (AES), discussing potential support for the ITEX network.

Denmark: The Danish authorities have now recognized ITEX, and Per Mølgaard (Copenhagen) has been granted economic support from the Commission for Scientific Research in Greenland for a five-year study at the Arctic Station, Disko Island, W Greenland, entitled "ITEX - Internation Tundra Experiment - Biological monitoring of climatic change by plant population dynamics". The site, which also has a Level 2 automatic climate station, is thus one of the leading ITEX field sites at present.

Iceland: Inga Svala Jónsdóttir (Lund, Sweden) brings the good news that the Icelandic National Science Foundation on 8 April supplied funding for the 1992 activities of ITEX in Iceland. A permanent ITEX site will now be settled, and experimentation and monitoring initiated. Congratulations!

Norway: Ann Marie Odasz (Tromsø) reports that she attended the Norwegian IGBP meeting at Oppdal, Trondheim, 26-27 March 1992, and informed about ITEX. The Norwegian Institute for Nature Research (NINA) is intertested in endorsing ITEX, but the meeting argued that Norwegian ITEX must be coordinated within IGBP-CGTE to get funding (this coordination is underway). The 1992 field activities will be concentrated to Ny-Ålesund, Svalbard, where Terry Callaghan and his U.K. team will continue temperature manipulations and other ITEX-related experimentation.

Sweden: The ITEX activities at the Latnjajaure Field Station (LFS) near Abisko in N Swedish Lapland will continue in the vegetation season of 1992. Some temperature manipulation designs, probably open-top chambers and simple two-sided clear-plastic shelters ("ITEX corners"), will be tried and evaluated. The climate station will be improved and a second datalogger for mobile experiments has been funded. The 1992 acitivities at LFS will start with snow-depth probings in mid-April (the snow cover on the E side of the lake was on average 3 m thick on April 4!). Mikael Stenström, University of Göteborg, has just been granted a four-year scholarship for his Ph.D. thesis work on *Saxifraga oppositifolia* within ITEX.

Within another Swedish Ph.D. project, Mats Havström and his supervisors Dr. Sven Jonasson (Denmark) and Dr. Terry Callaghan (U.K.), are currently investigating the effects of some simple environmental perturbations on the growth of *Cassiope tetragona*. The manipulations have been going on since 1989 at Abisko and since 1990 at Ny-Ålesund (Svalbard), and

consist of fertilization, shading and two types of temperature enhancement treatments as well as combinations of these treatments. A functional and very cheap design of a light-weight, still durable, dome-shaped plastic (polyethylene) greenhouse was constructed to enable true replication of the treatments to be made in remote areas. The greenhouse frame is also used for the shading treatment by substituting hessian for polyethylene.

One of the greenhouse designs with an open base has proven particularly successful in raising average temperature in the same range as the predictions of CO_2-induced global warming, without causing unrealistic changes of the maximum temperature. Also, the spectral distribution of transmitted light inside the greenhouses is not significantly altered and PAR reduced by only 9 %.

The different manipulations caused strikingly different responses in the vegetative growth pattern of shoots of *C. tetragona* among three climatically contrasting sites at Abisko and Ny-Ålesund. A paper which describes these results and discuss possible longer-term effects of global warming on the growth and distribution of *C. tetragona* was recently submitted to Oikos.

Other Countries: The U.K. ITEX-related activities will continue in Sweden (Abisko) and Svalbard (Ny-Ålesund). A British student, Richard Marsden, financed by the Natural Environment Research Council (NERC), will spend the 1992 summer season at the Swedish ITEX site, Latnjajaure, to do field work on snow-melt, phenology, and plant reproductive success in a number of species.

In the U.S., there is a proposal by a collaborative team (Marion, McGraw, Peterson, and Walker) to the NSF for funding ITEX work at three sites (Barrow and Toolik Lake in Alaska, Niwot Ridge in Colorado); the final size of U.S. involvement in ITEX field work will partly depend on NSF funding.

In Finland an ITEX field site in the mountains near the Kilpisjärvi Research Station was designated in 1991, when permanent tagging of *Saxifraga oppositifolia* individuals was started. In the 1992 season an ITEX climate station will probably be erected, with practical help from Urban Nordenhäll on a leave from the Swedish Latnjajaure site (NORDTEX student exchange program).

In Russia the financial situation for the national ITEX research group is troublesome at the moment, but they hope to implement programs in 1992. The Taimyr Peninsula is the main target area, but there are also field parties working in the Kola and Chukotka Peninsulas, interested in joining the ITEX.

Future Activities:

An international ITEX workshop is planned to take place in 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 discussing manual updating and revision, sharing, comparison, and analysis of data, and compilation of ITEX progress reports. Kari Laine is presently working on the details regarding where and how to house the meeting. A first ITEX report will be prepared after the meeting, and printed and distributed by the DPC. Note this important meeting in your agenda already today!

Other Meetings and News

21-26 April 1992. The International Arctic Science Committee meets in Reykjavik, Iceland on the role of global change in the Arctic. ITEX is represented by Pat Webber, our main interface between ITEX, IASC, IGBP, and MAB. Contact: IASC Secretariat, P.O. Box 158, 1330 Oslo Airport, Norway.

3-8 May 1992. 14th Polar Libraries Colloquy, Columbus, Ohio. The theme International Sharing of Polar Information Resources will be of interest to all tundra scientists. Contact: Lynn Lay, Byrd Polar Research Center, Ohio State University, Columbus, Ohio 43210-1308. FAX: 614-292-4697.

4-6 May 1992. Circumpolar Symposium on Remote Sensing of Arctic Environments, Tromsø, Norway. Contact: Roald Amundsen Centre for Arctic Research, University of Tromsø, N-9000, Tromsø, Norway; FAX +47-83-80-705.

8-10 September 1992. 5th International Symposium on Arctic Air Chemistry, Roskilde, Denmark. Contact: N. Z. Heidam or H. Flyger, National Environmental Research Institute, Fredriksborgvej 399, DK-4000 Roskilde, Denmark; FAX: +45-46-301114.

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Other meetings, continued . . .

18-22 September 1992. Disturbance Related Dynamics of Birch and Birch Dominated Ecosystems. Conference at Illugastadir, Fnjóskadalur, Iceland. Contact: Bjartmar Sveinbjörnsson, University of Iceland, Dept. of Biology, Grensásvegi 12, IS-108 Reykjavik, Iceland, or Asa L. Aradóttir, Iceland Forest Research Station, Mógilsá, IS-270 Mosfellsbaer, Iceland; FAX: +354-1-667750.

6-8 October 1992. Symposium on the State of the Environment and Environmental Monitoring in Northern Fennoscandia and the Kola Peninsula, Rovaniemi, Finland. Contact: Raija Kivilahti, Arctic Centre, University of Lapland, P.O. Box 122, SF-96101 Rovaniemi, Finland; FAX: +358-60-324270.

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.

We will circulate the next update in October 1992. 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, 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.