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ORGANIZERS:
International Institute for Applied Systems Analysis and Austrian Academy of Sciences

CONTACTS:

Sanja Drinkovic
Administrative Officer for IIASA Council and External Relations, Directorate
T: +43 2236 807 589
drinkovs@iiasa.ac.at

Mag. Marie-Therese Pitner
Austrian IIASA Commission at the Austrian Academy of Sciences
T: +43 1 51581-3452
pitner@oeaw.ac.at

REGISTRATION:
Mandatory Registration by 30 May at: depascal@iiasa.ac.at or pitner@oeaw.ac.at

ÖAW AUSTRIAN ACADEMY OF SCIENCES

IIASA

IN COMMEMORATION OF KURT KOMAREK
(23.06.1926 – 18.05.2016)

JOINT IIASA AND AUSTRIAN ACADEMY OF SCIENCES LECTURE

ON PLANTS AND CARBON

CHRISTIAN KÖRNER
Institute of Botany, University of Basel

MONDAY, 06 JUNE 2016
AUSTRIAN ACADEMY OF SCIENCES
FESTIVE HALL
DR. IGNAZ SEIPEL-PLATZ 2
1010 VIENNA

Christian Körner received his academic education at the University of Innsbruck, and is professor of Botany, University of Basel, Switzerland since 1989. He has authored many publications in alpine plant ecology and alpine treeline research including books, *Alpine Plant Life and Alpine Treelines*, and is coauthor of a publication on botany, *Strasburger*. Professor Körner is also known for his pioneering CO2-enrichment experiments in natural vegetation of all climatic zones. He is a member of the German National Academy of Sciences Leopoldina, the Austrian Academy of Sciences, and an honorary member of the Ecological Society of America. For further information please visit:
https://plantecology.unibas.ch/koerner/index.shtml

ON PLANTS AND CARBON

About half of the dry matter of organisms consists of carbon (C). The biosphere contains roughly 700 billion tons of C, largely tied to cellulose, the most abundant biological substance on earth. Forests store almost 90 % of the global biomass carbon reservoir. Carbon enters the biosphere by photosynthetic uptake of CO_2, and it leaves the biosphere by respiration of all non-green tissue and heterotrophic organisms. The balance between these fluxes was close to zero, before humans started to manage the planet. Now, humans release nearly 10 billion tons of carbon as CO_2 every year by burning fossil fuels and destroying forests, almost half of this CO_2 remains in the atmosphere, enhancing the green-house effect. Since plants can absorb CO_2 and store C, there is a debate on whether plants can mitigate atmospheric CO_2 enrichment. I will challenge these views, by recalling the basic rules of element ratios, the stoichiometry of life, and by emphasizing that fluxes of carbon (the carbon cycle) must not be confused with pools of carbon (carbon storage).

It needs about 25 chemical elements in the right proportion to build an healthy organism. Plants compete for most of these elements (for instance P, K, Mg, Mn, Mo) since they conquered land. Per unit land area, the availability of these elements is finite per unit land area. In contrast, the availability of CO_2 is theoretically infinite, and its acquisition is a matter of photosynthetic activity. Plants can absorb atmospheric CO_2 only to the extent, the availability of these other chemical elements permit. Only if the availability of all these elements is increasing in proportion to the rise of atmospheric CO_2 concentration, plants can capture more C. This explains, why experimental CO_2-enrichment of natural vegetation does not enhance plant growth and productivity, but it does, when applied together with a full nutrient solution or compound fertilizer or in very fertile soils, such as under horticultural conditions or in fast rotation tree plantations. Thus, there is no reason to expect a global CO_2-fertilization effect in the biosphere.

This debate is also tied to the still widespread assumption that faster tree growth, for whatever reason, represents 'carbon sequestration', i.e. a mitigation of atmospheric CO_2 enrichment by permanent C storage in the biosphere. This is as if one assumed cash flow to represent capital in economy. Growth is a process, tied into the global carbon cycle. Growth at one place has to be balanced with mortality or harvest elsewhere, and only if these two parts of the carbon cycle differ, the biospheric carbon capital can rise or fall. Hence, carbon storage of an area is a matter of carbon residence time, of tree age distribution (tree demography), and globally, it is a function of land area covered by high stocking forest, irrespective of the rate at which C cycles through these forests. Quite commonly, very productive forests (e.g. plantations) store less carbon than slow growing old growth forests. So, there is no straight-forward relationship between productivity and C storage. These rather basic aspects of the C cycle will be illustrated by empirical data.

PROGRAM

Moderation: Gerhard Glatzel | Chair Austrian IIASA Commission

18:30 **Welcome Remarks**
Anton Zeilinger | President of the Austrian Academy of Sciences

Dominik Hellsberg, 1. Violine; Clemens Hellsberg, 2. Violine and Benedikt Hellsberg, Violoncello
Johann Sebastian Bach (1685–1750), Konzert für zwei Violinen in d-Moll, BWV 1043
2. Satz (Andante)

18:50 **In Commemoration of Kurt Komarek**
Pavel Kabat | Director General & CEO of IIASA
Heinz Fassmann | Vicedean of the University of Vienna

19:10 **Peter Schuster** | University of Vienna
Kurt Komarek – a Life for Science

19:25 **Dorsamy (Gansen) Pillay** | National Research Foundation (NRF) of the Republic of South Africa, on behalf of the IIASA Governing Council
In Memoriam Kurt Komarek

19:40 **Keynote Lecture**
Christian Körner | Institute of Botany, University of Basel
On Plants and Carbon

20:30 RECEPTION (Aula)