



# „FloraGREIF“

## Greifswalder Digitales Informationssystem zur Flora der Mongolei

AG Kartographie und Geographische Informationssysteme  
am Institut für Geographie und Geologie (R. Zöllitz)

AG Allgemeine & Spezielle Botanik  
am Institut für Botanik u. Landschaftsökologie (M. Schnittler)

Universitäts-Rechenzentrum (J. Formella)

Aktueller Stand des Projekts: <http://greif.uni-greifswald.de/floragreif>

# The Problem

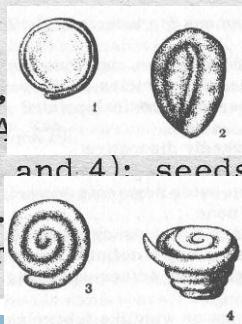
Printed determination books

- have long dichotomous keys,
- use numerous technical terms,
- show rarely pictures of the plants,
- and are often laid out for herbarium specimens and dissecting scopes, not for field work,
- are published in limited editions and are quite expensive.

Therefore, they are often limited to specialists, and it is difficult to check if you have keyed out the right species.

## I. Key to Genera

1. Embryo hippocrepiform or annular (Plate I, 1; seeds 12); seeds albuminous (Subfamily 1. Cyclolobeae C. A. .... 2.  
+ Embryo spirally coiled (Plate I, Figures 3 and 4); seeds exalbuminous (Subfamily 2. Spirolobeae C. A. M.) .... 25.
2. Roots and stems with normal anatomic structure; flowers solitary; seeds trigonous-oval with



# The needs

Plant identification skills are needed

- in developing countries for applied projects
- to teach undergraduate students in universities and schools,
- for our own students working in projects in these countries  
(vegetation ecology, grazing loads, local economies)

Specimens collected

- have to be verified by specialists
- are a resource for taxonomic research





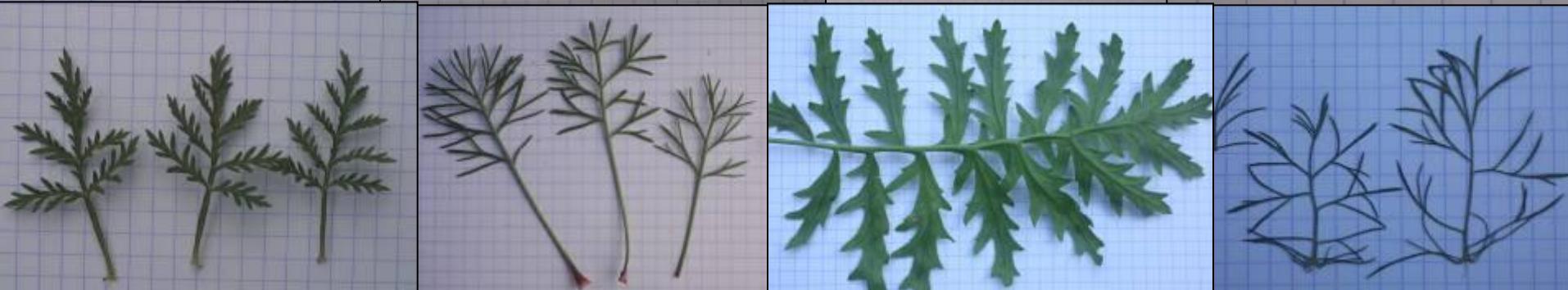
# The idea

Use rapidly evolving technologies available in developing countries as well:

- digital photography to document plants  
cheaper and smaller cameras, larger zoom lenses for details,  
high resolution CMOS sensors, high capacity storage media
- GPS systems to record exact coordinates for localities  
cheaper than ever, already as a component in mobile phones and cameras  
easy to use, reliable
- internet to disseminate information accessible for everybody  
more mobile than ever, accessible at low cost,  
able to transfer more information at high speed







# The solution

Create a system

- to identify by comparison
- and to check your identifications by combining:

Scans of  
herbarium  
specimens

Comparison  
material from  
large herbaria:  
well determined  
but dead

Living plants  
- growth form  
- habitat

New material:  
determination  
may be uncertain

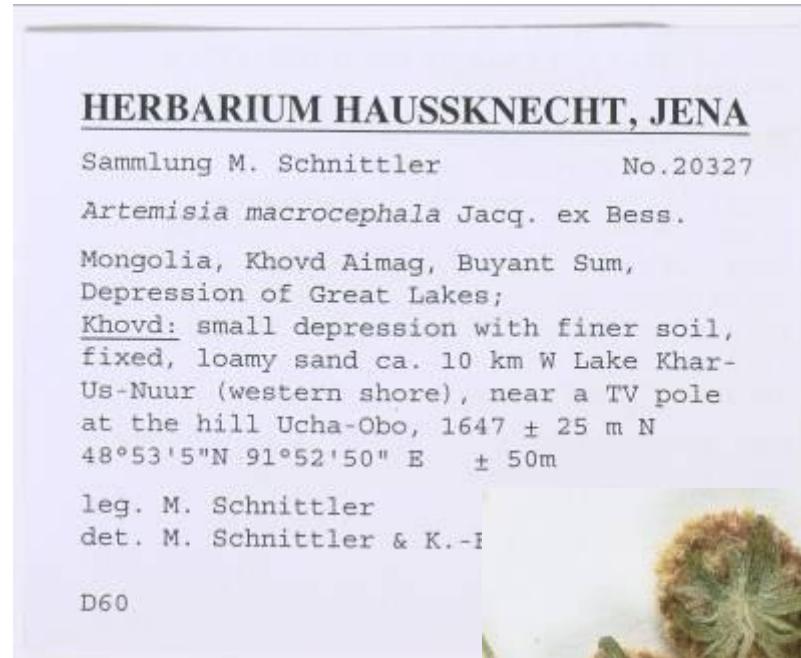
Use the rapidly  
developing opportunities  
of digital photography

Macro images  
of plant parts  
crucial for  
identification

New material:  
living plants  
showing all details



# Herbarium scans



# Living plants



# Macro images



# The advantages

- a system accessible for free by people in the countries  
(often without access to printed determination books)  
external specialists  
(which can use the digital records as resources for monographic works)  
teaching students and project personnel  
(to become familiar with a local flora in a short time)
- time-consuming and extensive loans from herbaria can be avoided  
high-resolution scans of herbarium specimens combined with detailed photographs of living specimens show all details
- "Digital" specimens can be collected without permits!
- accompanying information can be used for synthesis  
(example: a Web GIS application to compile distribution maps)

# The obstacles

- the system must  
reflect changes in taxonomy  
allow to search for species and places

But



- the system has to be  
user-friendly  
self-sustainable  
should allow to be extended with contributions of the user without  
involvement of computer specialists
- the user wants to see details of images as fast as possible  
(transfer online that bit of information what is needed...)

# Floristic data: Mongolia

- 2823 species in 662 genera (Gubanov 1996)
- largest families most important for vegetation ecology are  
Asteraceae      Fabaceae      Poaceae
- our strategy:
  - a) acquire as many images and scans as possible
  - b) give detailed information for especially important and taxonomically difficult groups, like  
*Artemisia* (key species for arid habitats)  
*Chenopodiaceae* (key species on salty soils)



# Where we are: species treated

## Field trips with living plant images - collections and images

Field trip	collections <sup>1</sup>	deposited in	collector	images <sup>2</sup>	photographer	records <sup>3</sup>	species <sup>4</sup>
Mo03	224	HFW	M. Schnittler	988	M. Schnittler	378	245
Mo07	353	JE	K.-F. Günther	1711	M. Schnittler	475	334
Rs08	307	BGBM	L. Martins	2130	M. Schnittler	637	469
Total	884			4829		1490	ca. 780 <sup>5</sup>

<sup>1</sup> specimens collected (usually only one specimen per plant species and field trip, with exceptions for taxonomically difficult groups)

<sup>2</sup> images of living plants in the field, general view and details, without habitat images

<sup>3</sup> plant specimens collected and/or photographed, one species treated at one locality constitutes one record

<sup>4</sup> approximate number of species treated (collected and/or photographed)

<sup>5</sup> due to species treated at more than one field trip, the app. total number of species treated is less than the sum from all field trips

# The components

Taxonomic backbone

taxon-related information:

- ecological data
- literature
- determination hints, synoptic keys...

Record data base

record-related information

- locality, collector...
- images of all kinds
- description. WebGIS

Search engines

for taxa of all hierarchy levels

for regional floras

for collectors and specialists who have  
verified determinations

and as an outcome a "virtual flora"

# Search Engine

Home      Search Plants      Project & Schedule      Methods & Standards      Team      Links

## FloraGREIF

targeted search

get an overview

Need help?

What are looking for?

Enter the taxon name:

family

Chenopodiaceae (612 rec) \*

genus

Atriplex (42 rec) \*

species

—

[taxon](#)

[record](#)

[image](#)

Enter additional information and refine your search:

[Taxon Information](#) [Herbar Records](#) [Images](#)

distribution:

[Choose distribution](#)

distribution khangay:  I  II  III  IV  V  VI

habitat:

[Choose habitat](#)

[advanced search](#)



# Search Engine

Home	Search Plants	Project & Schedule	Methods & Standards	Team	Links
<b>FloraGREIF</b>					
targeted search get an overview		<b>Brassicaceae</b> <u>58 genus 135 species</u>			
		<b>Butomaceae</b> <u>1 genus 2 species</u>			
		<b>Callitrichaceae</b> <u>1 genus 2 species</u>			
		<b>Campanulaceae</b> <u>4 genus 16 species</u>			
		<b>Cannabaceae</b> <u>1 genus 1 species</u>			
		<b>Capparidaceae</b> <u>1 genus 1 species</u>			
		<b>Caprifoliaceae</b> <u>4 genus 11 species</u>			
		<b>Caryophyllaceae</b> <u>22 genus 83 species</u>			
		<b>Celastraceae</b> <u>1 genus 1 species</u>			
		<b>Ceratophyllaceae</b> <u>1 genus 1 species</u>			
		<b>Chenopodiaceae</b> <u>25 genus 90 species</u> <u>612 records in 64 species</u>		 	
		<b>Convallariaceae</b> <u>3 genus 7 species</u>			
		<b>Convolvulaceae</b> <u>3 genus 11 species</u>			
		<b>Cornaceae</b> <u>1 genus 1 species</u>			
		<b>Crassulaceae</b> <u>5 genus 17 species</u>			

# Search Engine

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## FloraGREIF

targeted search  
get an overview

Need help?

name:	<b>Chenopodiaceae Atriplex fera (L.) Bunge</b> (acc. to Gubanov)
description:	leaves oblong-ovate to ovate lanceolate, entire; flowers in glomerules in leaf axils and end of spicate; fruiting bracts entirely connate, 2-6 mm long, highly convex, ovate, glabrous or infrequent with few appendages in middle portion
confuse with:	A. laevis C.A.Mey.
comments:	plants with spiny appendages on fruits are described as var. cornuta Hand.-Mazz. (see ** & Schnittler 2463)
habitat:	Moist clayey and puffy solonchaks, saline bottom and coasts of intermittent lakes, subsaline chee-grass communities, alkaline steppe depressions. (acc. to Grubov 2001)
growthform:	herbs annual (acc. to flora of china (1994 -) and grubov (2001))
herbar:	 <a href="#">5 records</a>



# Search Engine

Home

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## FloraGREIF

targeted search  
get an overview

Need help?

### Chenopodiaceae Atriplex

leg: K. Pist

det: Sanchez

teste: Rilke, S.

#### Herbar sheet

Index.Herb. GAT, I

Correra

Acc. No. 6099

herbar scan

[view](#)

#### Locality

country: Mongolia

region as written Solonchak

on label: Talbulag

#### Habitat

habitat as Solonchak

written on label:



# Search Engine

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FloraGREIF

targeted search  
get an overview

Need help?

images for family **Chenopodiaceae** genus **Atriplex** species **all**

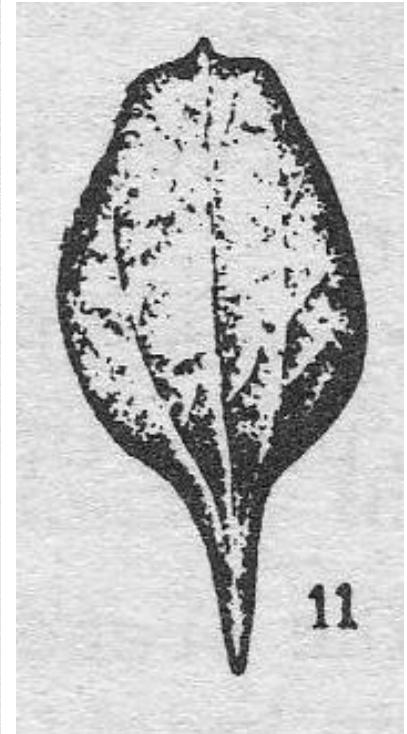


# A retrospective

33. *A. fera* (L.) Bge. in Mém. Acad. Sc. Pétersb. VII séér., XXVII, 8 (1880)  
6. — *Spinacia fera* L. Sp. pl. ed. 2 (1763) 1456. — *S. divaricata* Turcz.  
ex Moq. in DC. Prodr. XIII, 2 (1849) 118. — *Obione fera* Moq. in DC. Prodr.  
XIII, 2 (1849) 107; Fenzl in Ldb. Fl. Ross. III, 733; Turcz. Fl. baic. -dah. II, 2,  
26. — *O. lenticularis*, Moq. Chenop. (1840) 70. — *Atriplex lenticu-*  
*lare* C. A. M. in Turcz. cat. baic. -dah. no. 958 (1838) 15. — Ic.: Gmel., Fl.  
Sib. III, p. 86, t. 16.

Annual, 15–50 cm high; stem erect or ascending, simple or branched;  
leaves in lower part of the plant opposite, in upper part alternate, oblong-  
ovate to ovate-lanceolate, obtuse, entire, rounded-cuneate at base, more  
rarely sub hastate, narrowed to a petiole, green on both sides, the upper  
ones narrower and covered, like the inflorescence, with a subsequently  
exfoliating farinaceous film; flowers glomerate in the leaf axils and in a  
terminal spiciform inflorescence interrupted in fruit; staminate 4-merous;  
pistillate mostly in glomerules of 3–10, rarely solitary, bracteolate;  
bracteoles ovate, oval, or oblong-oval, distinctly stipitate in fruit, convex,  
united throughout, entire or at summit with 3 small teeth (of these the  
middle one acute, the lateral ones obtuse) or rarely 1-toothed, reticulate-  
nerved, in upper part sometimes muricate, mealy-scruffy; seeds round,  
flat, brown, smooth, 1.5–2 mm in diameter, with prominent radicle. July–  
August. (Plate IV, Figure 11).

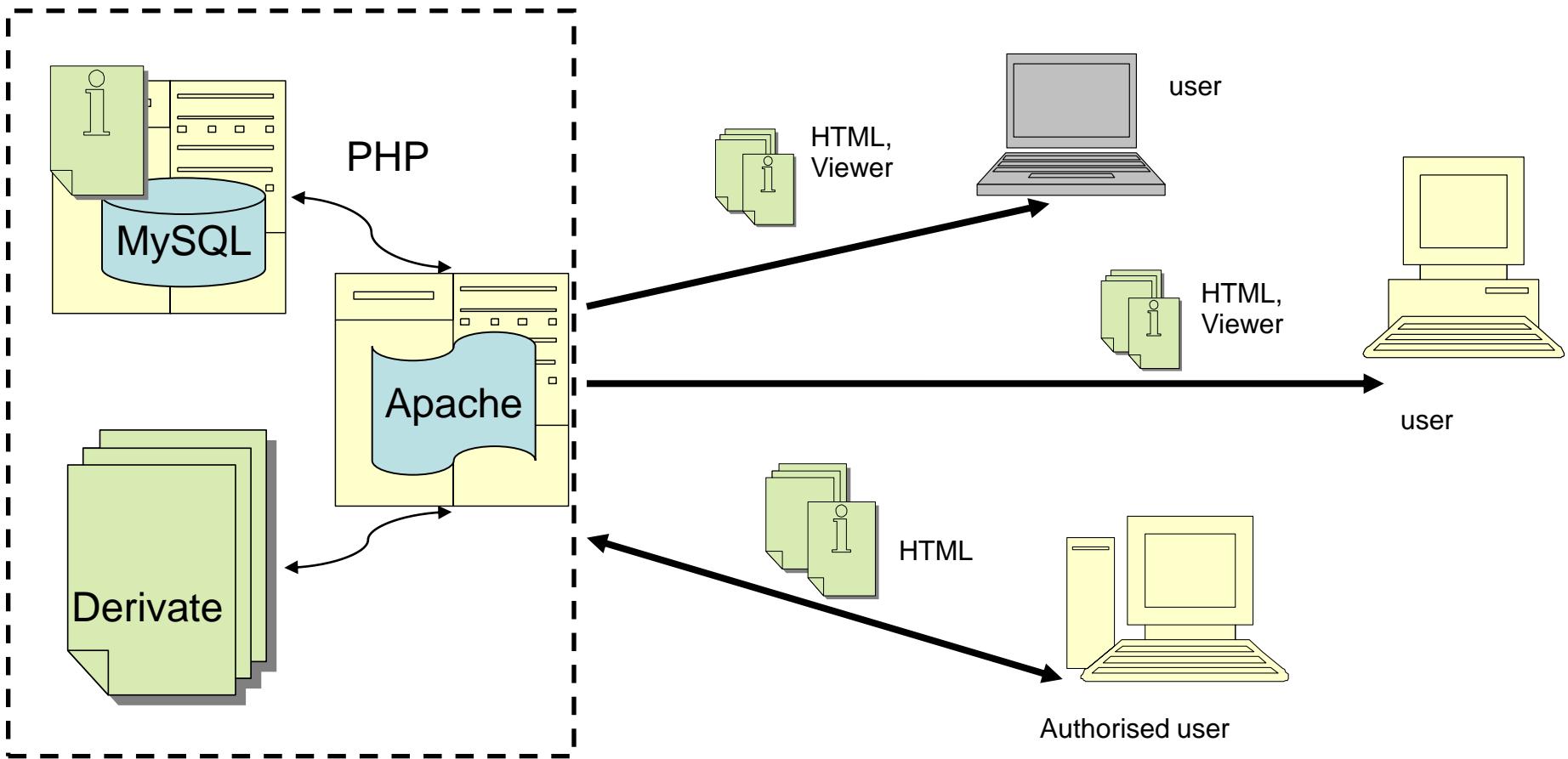
Solonetzes. — E. Siberia: Ang. -Say., Dau. Gen. distr.: Mong. Described  
from Siberia, from the vicinity of Krasnoyarsk, according to Gmelin's  
collection. Type in London.



# Prerequisites

- CMS GREIF
  - project „Digitales Archiv zur Schwedischen Landesaufnahme von Vorpommern 1692 - 1709“, funded by DFG from 11/2004 till 11/2006
  - <http://greif.uni-greifswald.de/geogreif>
- specifications
  - Apache web server
  - MySQL, Option: Oracle
  - data access via PHP
  - html templates

# CMS GREIF



# Implementation

- extend CMS GREIF to FloraGREIF
  - Add subject-specific components: taxon, record, search engine
  - Organise scan of herbar sheets, organise existing photo collections, additional macro photos
  - Choose an adequate viewer (ca. 200 MB)
  - Integrate WebGIS functionality

# Implementation: Taxon Data

search by family

search by genus

please choose a family or a genus acc. to Gubanov 1996

Currently listed: 128 families with 666 genus and 2810 species.

family	No. Genus	No. Species	Editor
<a href="#">Adoxaceae</a>	1 <a href="#">genus</a>	1 <a href="#">species</a>	
<a href="#">Alismataceae</a>	2 <a href="#">genus</a>	4 <a href="#">species</a>	
<a href="#">Alliaceae</a>	2 <a href="#">genus</a>	49 <a href="#">species</a>	
<a href="#">Amaranthaceae</a>	1 <a href="#">genus</a>	4 <a href="#">species</a>	
<a href="#">Apiaceae</a>	34 <a href="#">genus</a>	66 <a href="#">species</a>	
<a href="#">Apocynaceae</a>	2 <a href="#">genus</a>	2 <a href="#">species</a>	
<a href="#">Araceae</a>	1 <a href="#">genus</a>	1 <a href="#">species</a>	
<a href="#">Asclepiadaceae</a>	4 <a href="#">genus</a>	6 <a href="#">species</a>	
<a href="#">Asparagaceae</a>	1 <a href="#">genus</a>	9 <a href="#">species</a>	
<a href="#">Asphodelaceae</a>	1 <a href="#">genus</a>	1 <a href="#">species</a>	
<a href="#">Aspidiaceae</a>	1 <a href="#">genus</a>	2 <a href="#">species</a>	

Based on:

- Gubanov (1996)
- Grubov (1982)

Widely used determination books  
about Mongolian flora

Next Steps:

- manage own listings
- elaborate synoptic keys

# Implementation: Taxon Data

family	genus	species	author
Chenopodiaceae	Kochia	densiflora	Turcz. ex Moq.
subfamily	tribe	subspecies	author subspecies
Chenopedioideae	Camphorosmeae		

+  new in Gubanov (1996)

description

leaves glabrous or weakly pubescent, perianth glabrous; inflorescence densely spicate, tomentose-pilose with dense long hairs around flowers

confuse with

K. scoparia

comments

most likely very near to K. scoparia: there are a lot of sheets approaching with regard to hair-growth

distribution (1, ..., 16)

3,4,6,7,8,9,10,11,12,13,14

status ----> firstly described from geogr. region

--

distribution khangay

I  II  III  IV  V  VI

# Implementation: Record Data

Get all records where

family  genus  species

collector  collection number  Go!

Listing all records for family: **Chenopodiaceae** genus: **Atriplex**

[enter new record: Chenopodiaceae Atriplex](#)

			Sorted by Taxon Name						
	int. remarks	presentation remarks	record	leg	colno or date				
scan	üs	two branches with last fruits	Atriplex cana	H. Freitag & S. Rilke	26408b	<a href="#">edit</a>	<a href="#">rename</a>	<a href="#">delete</a>	
scan	üs fr	fruits completely connate	Atriplex fera	"W. Hilbig, Bumschaa u.a.	19.8.1977	<a href="#">edit</a>	<a href="#">rename</a>	<a href="#">delete</a>	
	Aimak Töv Sum Bajansogt?	fruits completely connate	Atriplex fera	Hilbig, Werner	45/81	<a href="#">edit</a>	<a href="#">rename</a>	<a href="#">delete</a>	
scan	üs fl	young flowering plant	Atriplex fera	K. Pistrick et Ch. Sanchir	106	<a href="#">edit</a>	<a href="#">rename</a>	<a href="#">delete</a>	
		completely connate	Atriplex fera	K. Pistrick et Ch. Sanchir	312	<a href="#">edit</a>	<a href="#">rename</a>	<a href="#">delete</a>	
			Atriplex fera	Hilbig, Werner	30.7.1977	<a href="#">edit</a>	<a href="#">rename</a>	<a href="#">delete</a>	

# Implementation: Record Data

Kochia densiflora Turcz. ex Moq. (Chenopodiaceae) **date:** 23.06.08

**leg.:** K.-F. Günther et M. Schnittler      **Date:** 08.09.2007      **No.:** 28071

**det.:** K.-F. Günther et M. Schnittler      **Date:**

**formerly det. as:**

**teste:** Rilke, Sabrina      **Date:** 23.6.08

**rev.:**      **Date:**

**flowering status:** flowering to fruiting plant

**comments for presentation:** dense long hairs around flowers and fruits, mature fruits with 5 equal lobes

## locality

geogr. data acc. to herbar label

Mongolei, Zentral-Aimak, Tal des Tola-Flusses (Tuul gol), Ulan-Bator (Ulaanbaatar),  
13,5\_km südwestl. vom Stadtzentrum, ca.\_4\_km südwestl. Jarmag, direkt vor dem  
Flughafengebäude

## coordinates

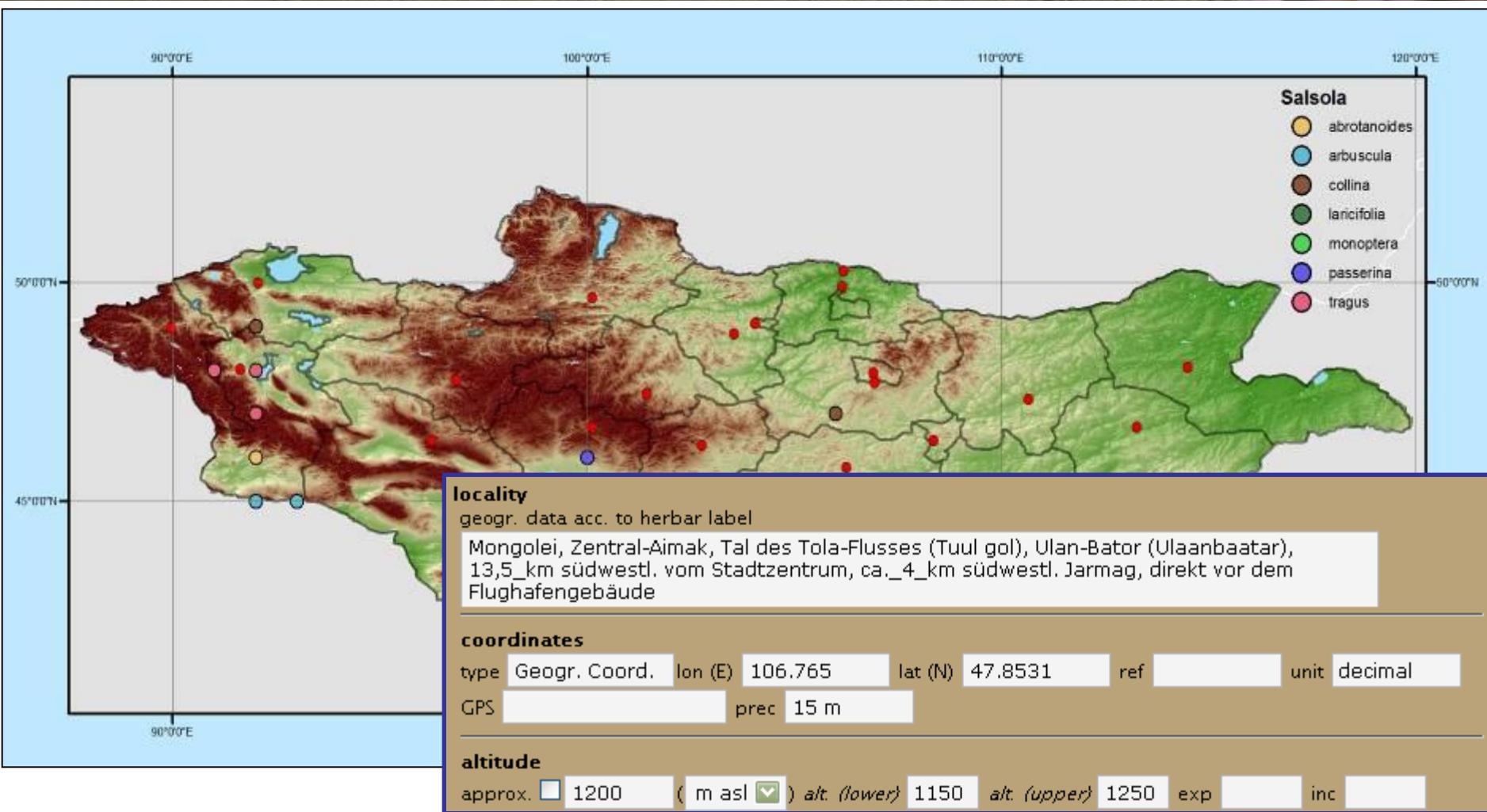
**type** Geogr. Coord.    lon (E) 106.765    lat (N) 47.8531    ref    unit decimal

GPS    prec 15 m

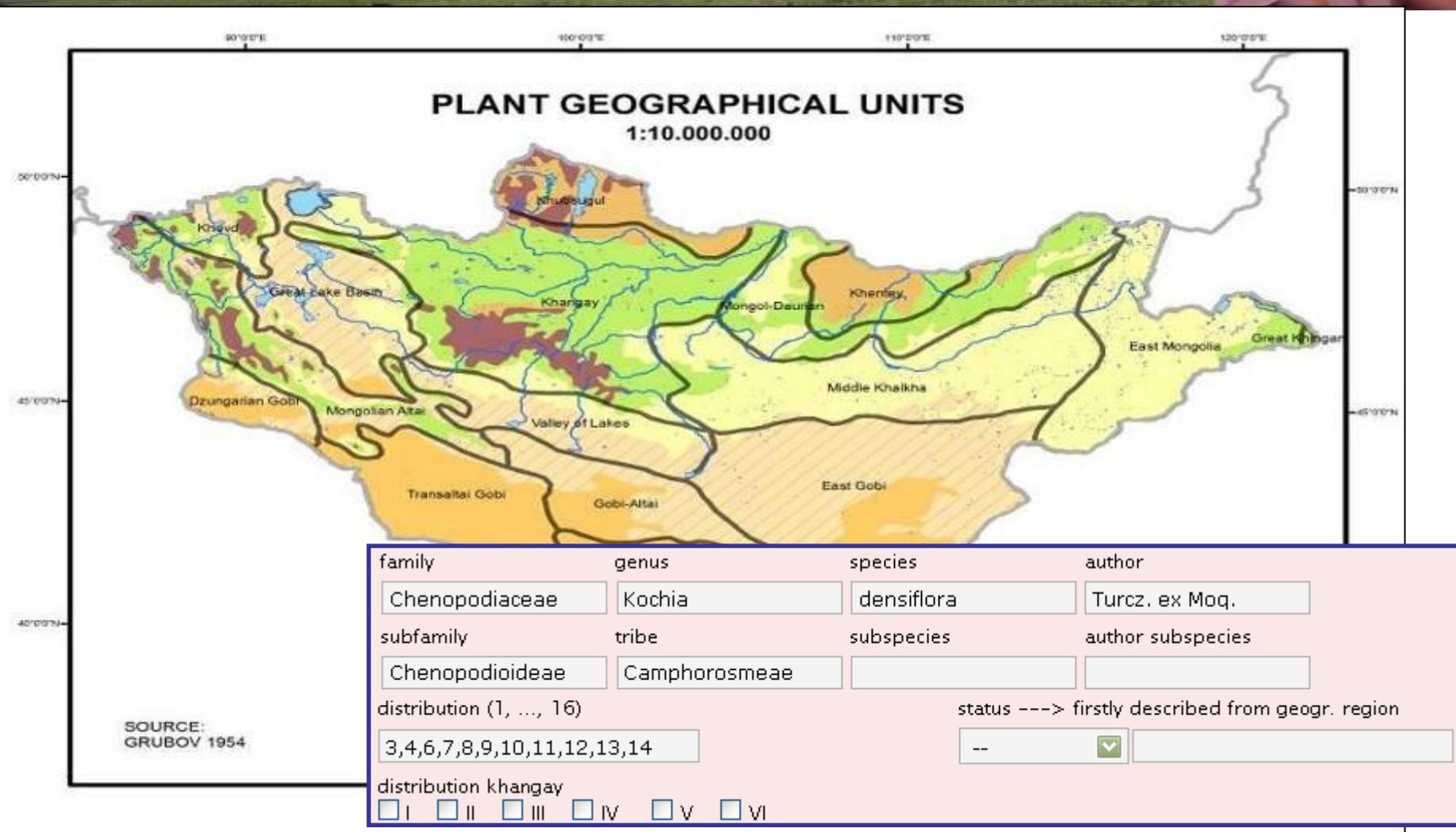
## altitude

approx.  1200 ( m asl  ) alt. (lower) 1150 alt. (upper) 1250 exp    inc

# WebGIS



# WebGIS



# WebGIS



# We are grateful to...

## Ernst-Moritz-Arndt-University Greifswald

- Dr. Anne Zemrich: Landschaftsökologie und Vegetationskunde der Mongolei, Weideökologie
- Dr. Sabrina Rilke: Systematik, Taxonomie, Nomenklatur, Chenopodiaceae (Salsola)
- Ulrike Najmi: Informatik
- Susanne Starke: Herbarfachkraft, Poaceae
- Jörg Hartleib: GIS

## Cooperation partners

- Botanischer Garten und Botanisches Museum (BGBM) Berlin Dahlem (Dr. Berendsohn)  
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- Herbarien: Halle, Gatersleben und Jena (Prof. Braune, Dr. Pistrick, Dr. Zündorf)  
mit umfangreichen Sammlungen zur Mongolei
- Institut für Geobotanik und Botanischer Garten der Universität Halle (Prof. Dr. em. E. Jäger)
- Mongolei: Akademie der Wissenschaften Ulaanbaatar; Universität Kovd (Dr. Tuvshin; Dr. O. Damdinsurengiin)

## Help from taxonomists

- Prof. H. Freitag (Suaeda, Kassel), Dr. H. Heklau (Krascheninnikovia, Halle), Dr. N. Kilian (Liguliflorae, Berlin), Dr. G. Laskov (Caryophyllaceae, Frunse), Dr. M. Maier Stolte (Ephedra, Kassel), Dr. E. Vitek (Euphrasia, Wien), Dr. R. Wisskirchen (Polygonaceae), Dr. N. Friesen ((Allium, Osnabrück)

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- Förderbereich Themenorientierte Informationsnetze; Laufzeit: vom 01.07.2007 bis zum 30.09.2010; Das Projekt soll nach Einführung in die Praxis ohne zeitliche Begrenzung weiterlaufen

A close-up photograph of an orchid flower against a black background. The flower has five petals: two long, slender, yellowish-green petals extending downwards and outwards; a shorter, broad, yellowish-green petal positioned horizontally; and a large, textured petal at the top with a mottled pattern of pink and light purple. A small white insect is visible on the central yellow petal. The overall appearance is delicate and intricate.

Thanks  
for your  
attention!