Implementation of the information system BExIS 2 at the UFZ:

Quality control, retrieval and sharing of [biodiversity] data

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Best practice elements and goals in **data management**

AIM: Reuse of data!

- Matter of **attitude** of people
  - Recognition of importance of data management
    - Top down and Bottom up!
  - Availability and **Open access** to data
- Defined **workflows** (acquisition-quality control-storage-publication)
- **Documentation** and selection of relevant data sets
  - Meta data standard for data description
- **IT issues**
  - Thesauri (controlled vocabulary)
  - Persistent storage / hardware
  - Magic tools: software solutions

Best practice elements and goals in **data management**

- Final step: DOI Data **publication** of **relevant** data sets

↓

Linking data to publications and people

↺ Feed back on willingness of data providers

Smiling data creators

Smiling users

The issue of **biodiversity data**

Mostly person-generated data!

- ○ Heterogeneity of data
- ○ Logic of ecologists related to data (different from IT people)
  - – Ecology: data based on spreadsheets ⇨ Data base?!

Quality control

- ○ Plausibility tests
  - – Expert knowledge
  - – Software (e.g. occurrence of species A at location B plausible?)
- ○ Technical consistency
  - – Correct data types
  - – Correct cell entries

BExIS - a generic data management **tool for biodiversity data**

Biodiversity **Ex**ploratories **I**nformation **S**ystem

- **BExIS 1**: Development started with DFG project Biodiversity Exploratories (2006) ⇨ information management system, project data base
  - **Instances**: DFG Biodiversity Exploratories, DFG Jena Experiment, DFG Research Group: Kilimanjaro, DFG Collaborative Research Centre 990: Ecological and Socioeconomic Functions of Tropical Lowland Rainforest Transformation Systems (Sumatra, Indonesia)
- **BExIS 2** (DFG-Project): generic open source information system for biodiversity data (funded until 2017; http://bexis2.uni-jena.de; live demo; download BExIS)
  - **Instances**: iDiv (DFG), AquaDiva (DFG), UFZ

BExIS: basic features

- ## Features
  - **Access**: free, as generic tool not restricted to biodiversity data!
  - **Import** of structured (spreadsheet-based) and unstructured data (e.g. images)
  - Internal **table-to-database** conversion
  - Data type **consistency check**
  - **Metadata** (import structures as xsd = xml schema definition)
  - **Export** (csv, xlsx)
  - Administration of **admission rights**
  - **Modular architecture** (data planning, data collection, data dissemination, data discovery, system administration)

BExIS: basic advantages

- Ideal for (large) projects and groups
  - all data including metadata are at **one place** (data base mangement in background)
  - **Web** interface
  - Individual data **access** management
  - Data base: even **search** within primary data
  - Ingests **all kind of data**
  - Dataset **versioning**

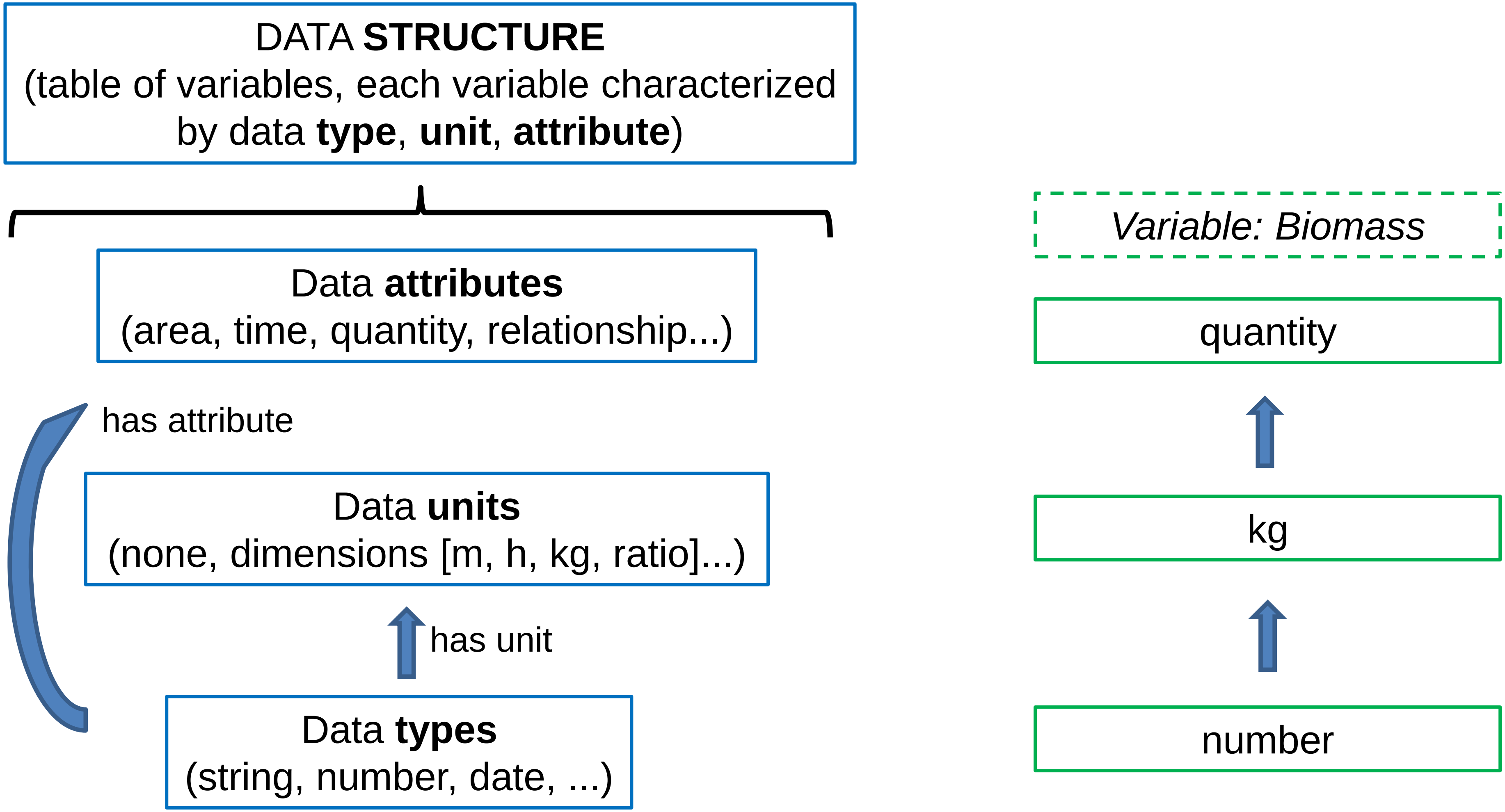
- Close interaction users ⇔ developers in project runtime
  - User and developer **conference June 9-10, 2016 in Jena** (Germany)

For IT administrators: Running BExIS

- ## Installation requirements
  - PostgreSQL or IBM DB2 Express-C
  - .NET Framework 4.5.2
  - Internet Information Service (IIS; Microsoft web server)

- ## UFZ instance
  - Virtual machine in DMZ – DeMilitarized Zone; outside firewall
  - Connected to LDAP (Lightweight Directory Access Protocol) ⇨easy login for UFZ users
  - accessible as web application within intranet UFZ (bexis.ufz.de)
  - https access for outside world possible

Getting organized by software



DATA **STRUCTURE**
(table of variables, each variable characterized by data **type**, **unit**, **attribute**)

Data **attributes**
(area, time, quantity, relationship...)

has attribute

Data **units**
(none, dimensions [m, h, kg, ratio]...)

has unit

Data **types**
(string, number, date, ...)

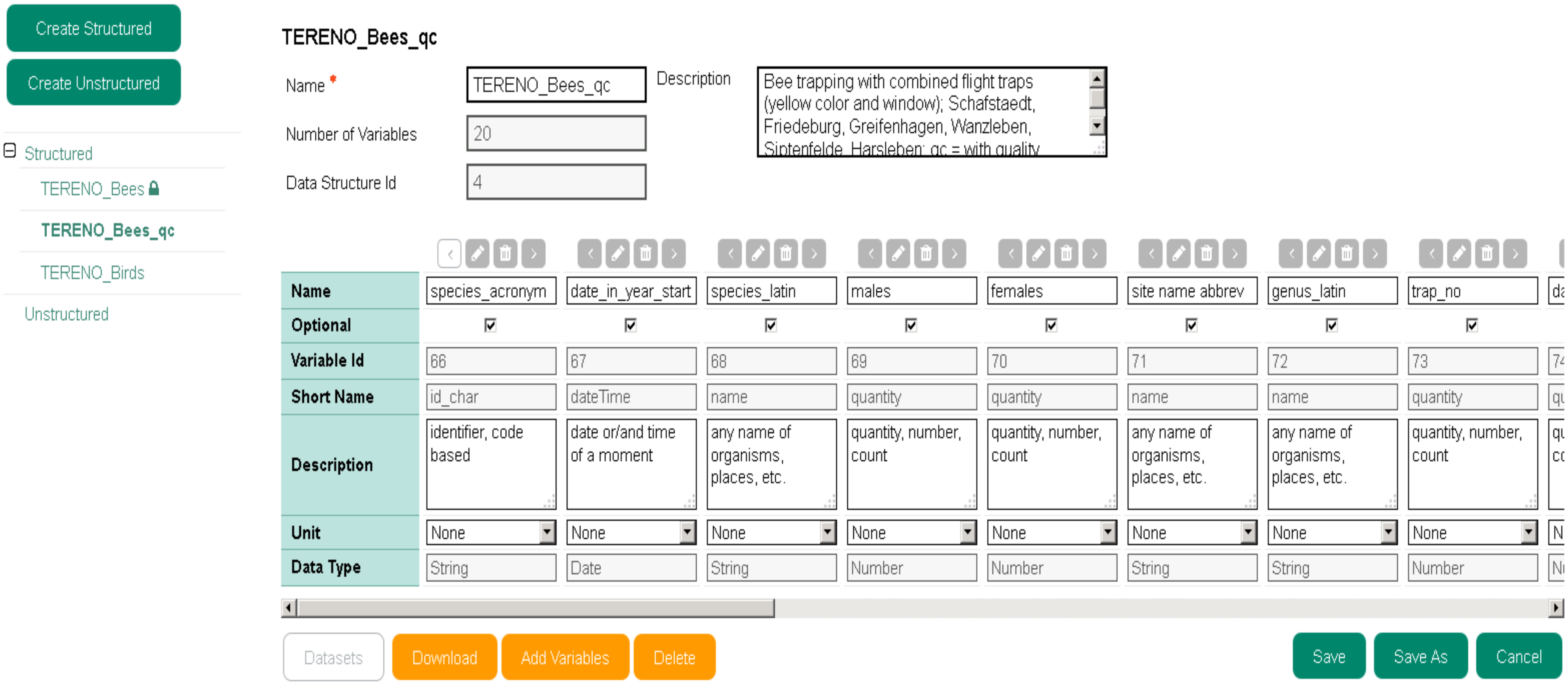
Variable: Biomass

quantity

kg

number

Data structure ⇨ download Excel template



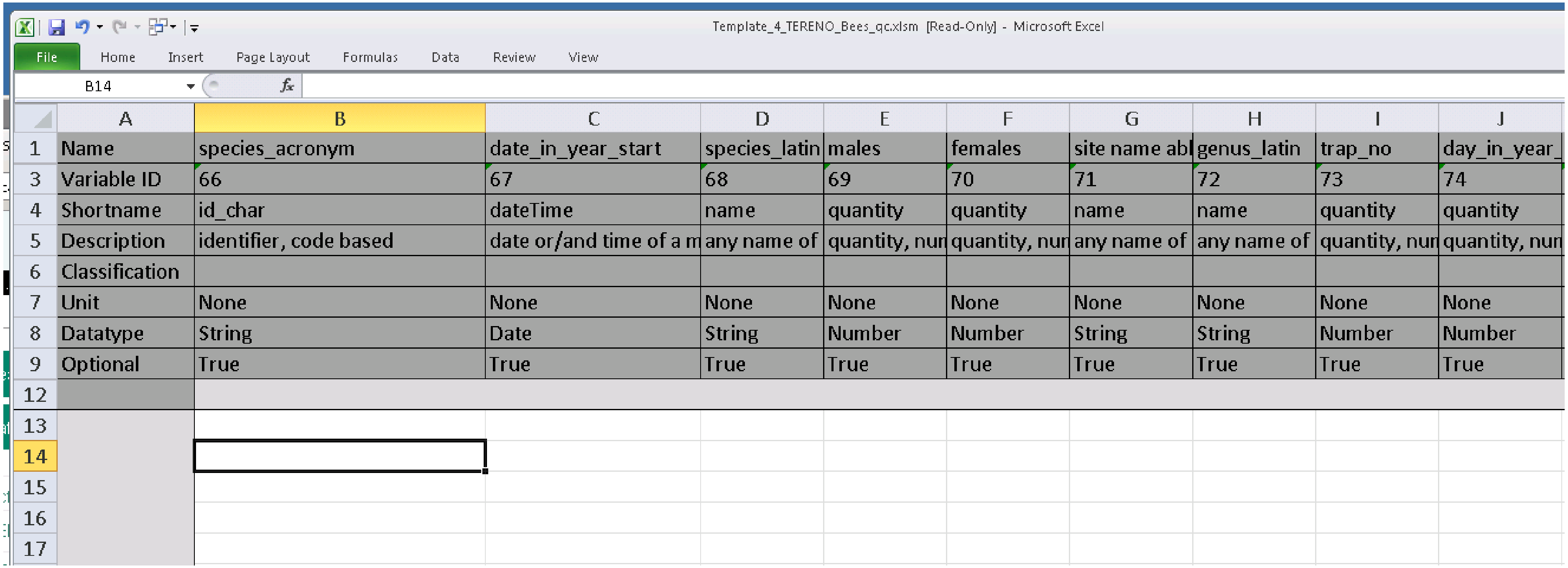
TERENO_Bees_qc

Name *	TERENO_Bees_qc	Description	Bee trapping with combined flight traps (yellow color and window); Schafstaedt, Friedeburg, Greifenhagen, Wanzleben, Siptenfelde, Harsleben; qc = with quality
Number of Variables	20		
Data Structure Id	4		

Name	species_acronym	date_in_year_start	species_latin	males	females	site name abbrev	genus_latin	trap_no	da
Optional	☑	☑	☑	☑	☑	☑	☑	☑	
Variable Id	66	67	68	69	70	71	72	73	74
Short Name	id_char	dateTime	name	quantity	quantity	name	name	quantity	qu
Description	identifier, code based	date or/and time of a moment	any name of organisms, places, etc.	quantity, number, count	quantity, number, count	any name of organisms, places, etc.	any name of organisms, places, etc.	quantity, number, count	qu co
Unit	None	None	None	None	None	None	None	None	N
Data Type	String	Date	String	Number	Number	String	String	Number	Nu

Excel template (xlsm)

Template with complete data structure entries and **makro** running in the background



Template_4_TERENO_Bees_qc.xlsm [Read-Only] - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J
1	Name	species_acronym	date_in_year_start	species_latin	males	females	site name abl	genus_latin	trap_no	day_in_year_
3	Variable ID	66	67	68	69	70	71	72	73	74
4	Shortname	id_char	dateTime	name	quantity	quantity	name	name	quantity	quantity
5	Description	identifier, code based	date or/and time of a m	any name of	quantity, nur	quantity, nur	any name of	any name of	quantity, nur	quantity, nun
6	Classification									
7	Unit	None	None	None	None	None	None	None	None	None
8	Datatype	String	Date	String	Number	Number	String	String	Number	Number
9	Optional	True	True	True	True	True	True	True	True	True
12										
13										
14										
15										
16										
17										

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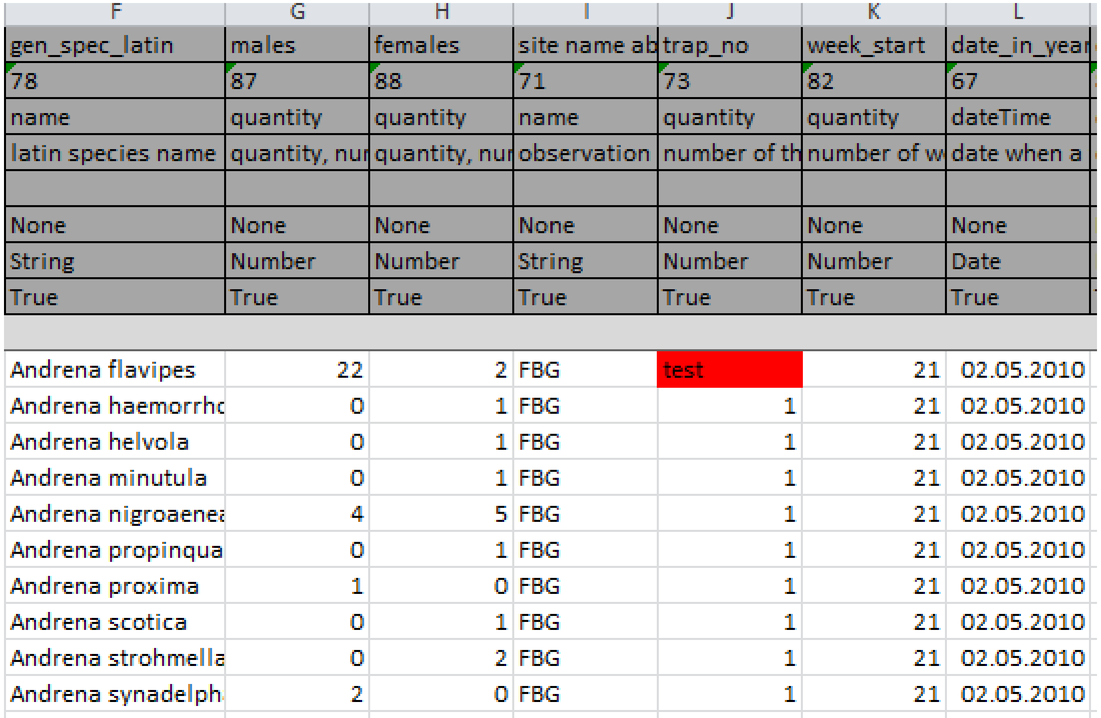
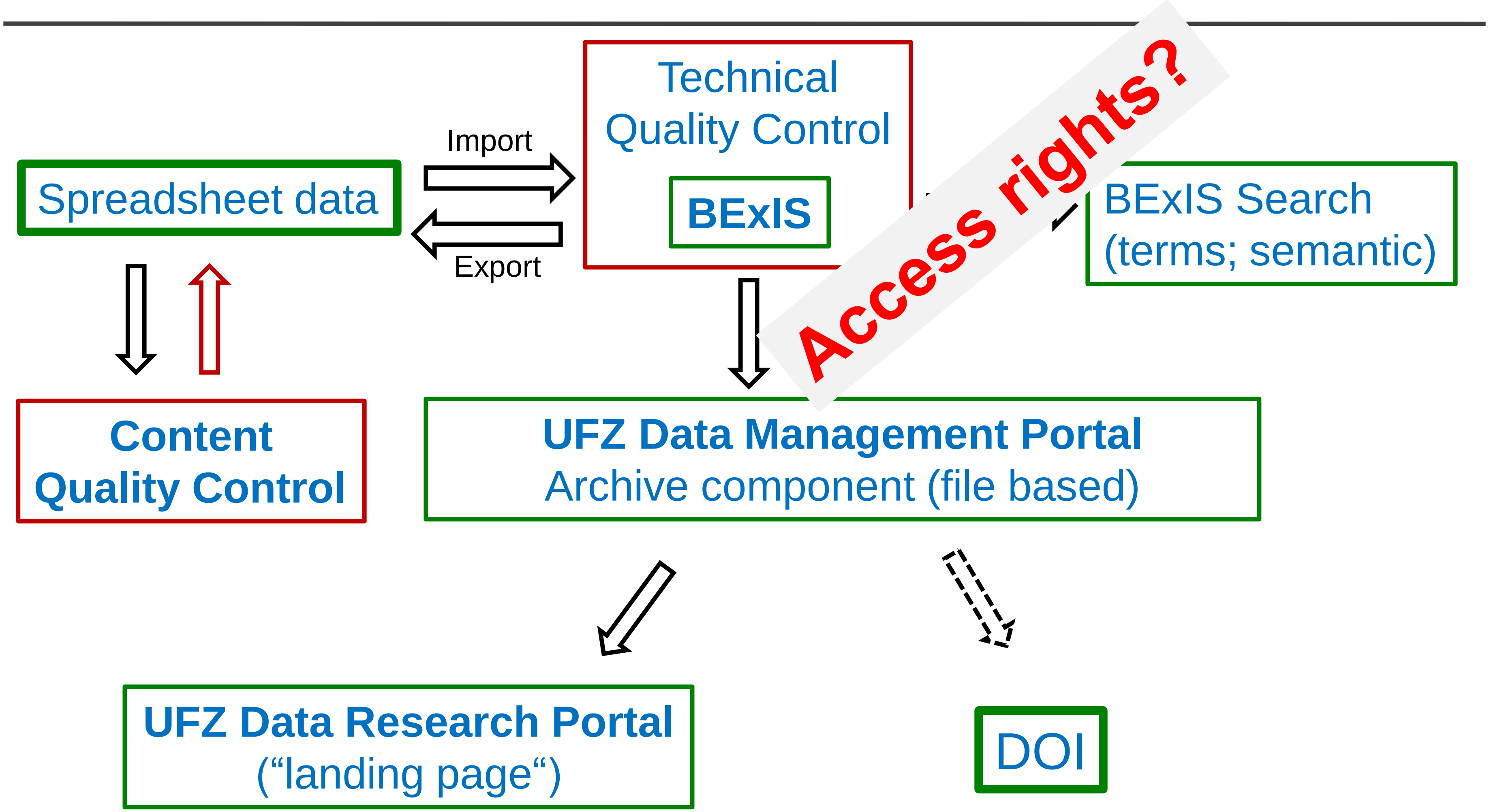
Excel template (xlsm)

- Copy & paste your data in the template
- Data type consistency check ⇨ example: “test“ is no number and thus indicated by the red cell

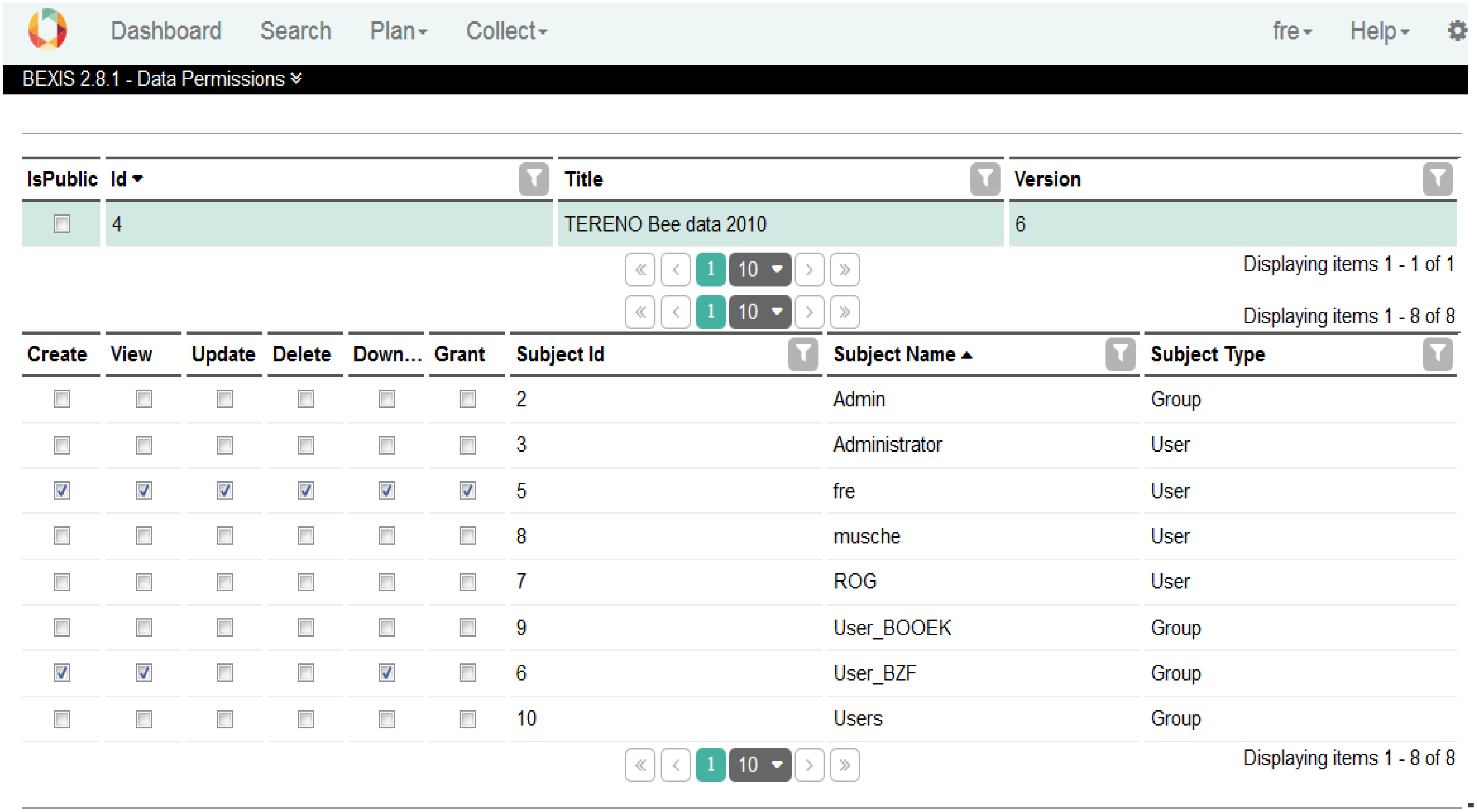


F	G	H	I	J	K	L
gen_spec_latin	males	females	site name ab	trap_no	week_start	date_in_year
78	87	88	71	73	82	67
name	quantity	quantity	name	quantity	quantity	dateTime
latin species name	quantity, nu	quantity, nu	observation	number of th	number of w	date when a
None	None	None	None	None	None	None
String	Number	Number	String	Number	Number	Date
True	True	True	True	True	True	True
Andrena flavipes	22	2	FBG	🟥 test	21	02.05.2010
Andrena haemorrho	0	1	FBG	1	21	02.05.2010
Andrena helvola	0	1	FBG	1	21	02.05.2010
Andrena minutula	0	1	FBG	1	21	02.05.2010
Andrena nigroaenea	4	5	FBG	1	21	02.05.2010
Andrena propinqua	0	1	FBG	1	21	02.05.2010
Andrena proxima	1	0	FBG	1	21	02.05.2010
Andrena scotica	0	1	FBG	1	21	02.05.2010
Andrena strohmella	0	2	FBG	1	21	02.05.2010
Andrena synadelph	2	0	FBG	1	21	02.05.2010

Workflow for biodiversity data at UFZ



Manage users | groups | features | **data permissions**



IsPublic	Id	Title	Version
□	4	TERENO Bee data 2010	6

Displaying items 1 - 1 of 1

Displaying items 1 - 8 of 8

Create	View	Update	Delete	Down...	Grant	Subject Id	Subject Name	Subject Type
□	□	□	□	□	□	2	Admin	Group
□	□	□	□	□	□	3	Administrator	User
☑	☑	☑	☑	☑	☑	5	fre	User
□	□	□	□	□	□	8	musche	User
□	□	□	□	□	□	7	ROG	User
□	□	□	□	□	□	9	User_BOOEK	Group
☑	☑	□	□	☑	□	6	User_BZF	Group
□	□	□	□	□	□	10	Users	Group

Displaying items 1 - 8 of 8

Larger context: www.**gfbio**.org

German **F**ederation for **Bio**logical Data (GFBio; DFG project; BExIS is a component)

“sustainable, service oriented, *national data infrastructure* facilitating data *sharing* and stimulating data intensive science in the fields of *biological and environmental* research”

- **Data focus**: genome data, ecological and environmental data, collection related data
- **Coverage**: full life cycle of research data ⇨ field or real time data acquisition ⇨ long term archiving ⇨ **publication** ⇨ re-analysis and re-use

From data management to **DOI for data sets**

DOI = Digital Object Identifier

BExIS ⇨ important step towards DOI quality of data sets

Why DOI for data sets?

○ **Credits** to data producers / owners

○ **Persistent** identifiers, persistant storage

○ Standardised **metadata**

○ Increasing requirement from **publishers**

○ Easy access *via* individual **landing page** (url) for each data set

From data management to **DOI for data sets**

One option ⇨ PANGAEA (www.pangaea.de; publication agent for dataset DOI)

Features of PANGAEA

- ○ Jira **ticket system** for data submission and documentation
- ○ **Editorial system** (4D client)
- ○ Structured data splitted to **database**
- ○ **Ontologies** behind
- ○ **Database + Ontology = Data warehouse** ⇨ essential for **reuse** and new combination of related datasets!

Link to exemplary landing page in PANGAEA