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Agricultural Soil Science in Universal Classification Systems. A Comparative Analysis*

Nocetti, M.: Agricultural soil science in universal classification systems. A comparative analysis.
In: Intern. Classificat. 5 (1978) No.1, p.15–20
This comparative analysis for the field of agricultural soil science in the DDC, BBC and LCC discusses presentation, structure and material relationships in these systems. Inconsistencies from several points of view are pointed out. A new structure is created using the elements of all three systems, grouping them in several facets and arranging them in an order facilitating their citation order. Some application examples show the applicability of the proposed system. Author

1. Introduction

The application of general and universal classification systems in agricultural libraries has been unsatisfactory for librarians and users.

Latin American countries are characterized by a special predilection for the Dewey Decimal Classification (DDC), as shown by the survey carried out by the Inter-American Institute of Agricultural Sciences, IICA (14). This survey revealed that of 223 agricultural libraries in 22 Latin American countries, 129 use DDC (57.85%), 29 use the Universal Decimal Classification (UDC) (13%) and 11 use the Library of Congress Classification (LCC) (4.93%). The others are divided over various minor systems or do not use any classification system at all, as can be seen in Table No.1.

The reason for this tendency is perhaps to be found in the adoption of the DDC by the Inter-American Institute of Agricultural Science Library, which has always been, and still is, the leader of and advisor on the Latin American agricultural librarians' activities. It has developed intensive training programs for librarians, including DDC application to agricultural libraries, in its curricula of study (5). The staff of this library prepared the translation of the 630 (Agriculture) section of DDC 18 on behalf of the Pan-American Union (1).

* This article is based on one of the very good term papers delivered in the second half of a 6-weeks course on Classification Theory, IBICT, Rio de Janeiro, Aug.–Sept. 1976 under the guidance of Dr. I. Dahlberg. For a description of the term paper assignment please see Intern. Classificat. 3 (1976) No. 2, p. 103–104.

The Inter-American Association of Agricultural Librarians and Documentalists also cooperated in the dissemination of the DDC in publishing a technical bulletin on the programmed teaching of the system (15). The only country that seems to escape the general tendency is Peru, as is evident from the survey by IICA and from another one done by Hernandez de Caldas (10). The National Agricultural Library of this country adopted the LCC, and several agricultural libraries have done the same. Library of Congress practices have a big influence in Peru, where a translation into Spanish was made of the agricultural terms of the Library of Congress Subject Headings, thus providing the first and so far the only list of Spanish subject headings in the agricultural sciences (4).

It is significant how little acceptance Frauendorfer's system for agricultural science classification has found, expecially since a Spanish translation prepared in Argentina is available (7), (9).

Brazilian libraries, according to a special survey prepared for the 3rd Round Table of the Inter-American Program for Agricultural Libraries Development, in 1969, show the same tendency as the other Latin American countries:

"... we note that despite the existance of the 63-class system developed by D. Kervégant (12), the Dewey Classification continues to deserve the preference of agricultural librarians" (17).

In 1974 the Brazilian Commission for Agricultural Documentation (CBDA) carried out a survey of agricul-

Table No. 1: *Classification systems used in Latin American agricultural libraries (from M. D. Malugani, 14)*

Country	DDC	UDC	LCC	OXF	IIA	D/OXF	n/inf.	n/clas.	Total
Argentina	6	22	–	1	4	–	3	2	38
Bolivia	1	–	1	–	–	–	3	–	5
Brazil	45	4	1	–	1	–	5	3	59
Colombia	14	–	1	1	–	–	1	1	18
Costa Rica	3	–	–	–	–	–	–	–	3
Cuba	–	–	–	–	–	–	6	–	6
Chile	7	1	–	2	–	–	–	–	10
Dominican R.	–	–	–	–	–	–	1	–	1
Ecuador	8	1	–	–	–	–	1	–	10
El Salvador	3	–	–	–	–	–	–	1	4
Guatemala	3	–	1	–	–	–	1	–	5
Haiti	1	–	–	–	–	–	–	–	1
Honduras	2	–	–	–	–	–	–	–	2
Mexico	10	–	–	1	–	–	4	–	15
Nicaragua	1	–	–	–	–	–	–	–	1
Panama	1	–	–	–	–	–	1	–	2
Paraguay	1	–	–	–	–	–	–	–	1
Perú	7	–	5	1	–	–	3	1	17
Puerto Rico	2	–	–	–	–	1	–	–	3
Trinidad	–	–	1	–	–	–	–	–	1
Uruguay	4	1	–	–	1	–	1	1	8
Venezuela	10	–	1	1	–	–	1	–	13
Total	129	29	11	7	6	1	31	9	223
%	57.85	13	4.93	3.14	2.69	0.45	13.90	4.04	

DDC	Dewey Decimal Classification
UDC	Universal Decimal Classification
LCC	Library of Congress Classification
OXF	Oxford (Forestry)
IIA	International Institute of Agriculture
D/OXF	Combination of Dewey and Oxford
n/inf	No information
n/clas	No classification system used

tural libraries of the country. Results related to classification systems pointed out that of the 81 agricultural libraries in Brazil 49 use the DDC, 27 the UDC, 2 the LCC and 3 still rest without any classification (21).

Since 1974 the number of users of Dewey in Brazil has increased, particularly with the adoption of this system by the Brazilian Enterprise of Agricultural Research, EMBRAPA, which operates a network of about 40 agricultural libraries.

After this short introduction outlining the general tendencies in the use of major library classifications on the Latin American scene, we will now look at the classification problems "in vitro". We will try to point out the main inconsistencies and failings of different universal classification systems through a comparative analysis of a special subject field of agriculture.

2. Materials and methods

Agricultural soil science was selected as a special subject field to make a comparative analysis between the DDC (6), Bliss' Bibliographic Classification (BBC) (2) and LCC (20). UDC was not considered, due to its close relationship to the DDC system.

Structures (facets) and material relationships will be analyzed thus taking into account the dispersion of the field throughout the scheme.

A quantitative analysis of the structure is presented in Tables No. 2 and No. 3. The distribution of concepts in the schedules is shown in Table No. 3. In order to get more concepts from LCC, the cumulation of additions and changes through 1973 as published by Gale Research Co. was used (19).

An outline of a new faceted classification on the basis of the concepts found in the systems mentioned is attempted and some application examples are given.

3. Analysis in focus

3.1 Dewey Decimal Classification (DDC)

Foskett (8) had pointed it out already:

> "The limitation of division by ten, the allocation of all major divisions in the first edition, the failure to distinguish between the various kinds of relations, the collocation of unrelated subjects, and the subordination of coordinate subjects, have all contributed to its supersession."

In fact, the Dewey system is generally criticized in the technical literature. Comparative analyses in special subject fields, for example the one done by Casellas, put it in the worst position (3). Interesting observations on the inconsistencies of the DDC as applied to agricultural sciences can be found in a paper presented by S. Salas to the 2nd Inter-American Meeting of Agricultural Librarians and Documentalists. He called attention to some problems related to the dispersion of the subject in the whole schedule and the repetition of some fields, such as phytopathology, that can be classed at three different places (18).

Agricultural soil science is classed inside agriculture, at 631.4. Curiously, the subject is then interrupted in 631.5, where *Cultivation and harvesting* appears, to be continued, however, in 631.6 with *Soil improvement*, at .7 with *Irrigation* and at .8 with *Fertilizers and soil conditioners.*

Soil Chemistry and *Soil physics* are separated from *Soil biology* by concepts that do not seem to be of the same category, such as *Soil classification* and *Soil erosion and its control.*

A similar inconsistency is formulated at .8 *Fertilizers and soil conditioners*: under 631.81 aspects relative to fertilizers are dealt with, after that, under 631.82, *Soil conditioners*, returning in 631.83 to *Specific kind of fertilizers.*

The system contains some material relationships, such as a partition relation in *Soil chemistry* which is subdivided into the big fields: *Inorganic* and *Organic.*

We find hierarchical relations too, namely in:

Animal manures
- Farmyard manures
- Guano
- Sewage sludge

and functional relationships, such as:

Soil conditioners
- for control of acidity
- for control of alkalinity
- for texture

The quantitative viewpoint will be treated in our Conclusion in order to facilitate comparison.

3.2 Bliss' Bibliographic Classification (BBC)

The first attempt to find Agricultural Sciences in the Bliss schedule (of 1953) produces an "alarming" result. Unquestionably, the staff of the Food and Agricultural Organization, FAO, would be very unhappy to know that agriculture is considered part of a main class called: *Arts: useful industrial arts and the less scientific technology*, to be identified by the letter "U".

The Bliss system, contrary to that of Dewey, presents our specific subject field without separations:

UAG Soils for agriculture
UAH Hydrology of soils and in agriculture
UAI Irrigation
UAJ Fertilizers

but, in the same way as the other one, has some dispersion in the schedule, especially under Botany, namely under FF, *Ecology of plants*, which in FFD and FFE presents *Soil-water; Edaphic relations to soil, Diseases in soil; Alkaline soils; Acid soils*, etc.

The arrangement of the structure is not very logical. Terms such as *Microbiology of soils* have the same value as an old agricultural practice: *Fire, effects of, on the soil*, or as concepts such as *Humus. Fertilizers* and *Manures* receive the treatment of "liquid", but they are not treated in terms of any other categories of the state of materials.

While *Microbiology of soils* appears in UAGE, *Microorganisms in soil* appears in FFEE.

Some hierarchical relationships can be found, such as:

Fertilizers
- Natural fertilizers

or:

Mineral and metallic constituents
- Boron, calcium, copper, magnesium, sulfur, etc.

These are some of the characteristics, relationships and inconsistencies of the Bliss system. The results of a quantitative analysis will be presented in the Conclusion.

No literature about successful or unsuccessful applica-

tion to agriculture has been found, perhaps due to the limited use of this classification system.

3.3 Library of Congress Classification (LCC)

Based on the "literary warrant" principle (8), the LCC structure and purpose was characterized by Immroth as follows:

> "LCC was not based on any philosophical system for classifying knowledge. It was designed to classify the books of the Library of Congress collection and future expansions of the collections... This system was not intended for use by any library other than the Library of Congress" (11).

As Putnam said, the system devised has not sought to follow strictly the scientific order of subjects (16).

D. Lee showed the advantages and disadvantages of using LCC in an agricultural library, pointing out the fact that the U.S.National Agricultural Library, the largest in the world, adopted LCC in 1966 (13).

In the same way as in the BBC, our specific subject field is presented in a sequence.

It does not have a logical structure, and the concepts appear rather in a mixed "order". Under *Fertilizers and improvement of the soil* we find:

645 Potash
647 Phosphates. Potassium
649 Guano
651 Nitrogen and nitrates

It is not easy to understand why *Guano* appears between chemical elements rather than being grouped with other manures.

Another example is *Alkali lands* which, although being a special kind of land, appear between *Soil moisture* and *Soils for special crops. Soil temperature* is subordinate to *Soil moisture*, although both are concepts of the same category.

The treatment that was given to the concepts when trying to establish a hierarchical relationship is no less arbitrary. *Special classes of land* group several kinds of land, each one characterized from a different point of view. For example, *Abandoned land* is characterized in terms of its use by man, *Deserts* in terms of physiography, and *Arid land* in terms of climate.

This "special" hierarchical relationship contains functional relationships, because with each kind a measure for improvement is presented:

Woodlands. Clearing
Deserts, arid lands. Irrigation
etc.

4. Number and distribution of classes and their terms in the DDC, BBC and LCC

Table No.2 gives an account of the number of classes and their subdivisions on the three following levels in the field of agricultural soil science in the systems under investigation.

Table No.2: *Quantitative analysis regarding structure and notation of the special subject field*

Classific. system	Main Class	Div. (1)	Subdiv.(2)	Subsubdiv.(3)
DDC	3	17	27	3
BBC	5	37	–	–
LCC	2	37	1	–

Table No.3 lists in alphabetical sequence all the 142 terms found in the three systems and indicates their special occurrence in either one or two of the systems. Interestingly enough, no terms occur in all the three systems alike.

Table No.3: *Alphabetical list of terms from the DDC, BBC, and LCC and their distribution in the systems*

TERMS	SYSTEMS		
	DDC	BBC	LCC
ABANDONED FARM LANDS			X
ABATTOIR RESIDUES	X		
ACID PHOSPHATES		X	
ACID SOILS		X	
ALKALI LANDS			X
ALUMINIUM			X
AMMONIUM, UREA, CYNAMIDE FERTILIZERS	X		
ANALYSIS AND EXPERIMENTS			X
ANIMAL INDUSTRY REMAINS			X
ANIMAL MANURES	X		
ARSENIC			X
BARIUM			X
BIOCHEMISTRY	X		
BORON		X	X
BURNING OF LAND			X
CALCIUM	X	X	
CARBON		X	
CHEMICAL AND MINERALOGICAL CONSTITUENTS		X	
CHEMICAL, COMMERCIAL FERTILIZERS, GENERAL		X	
CITY SEWAGE AND HUMAN EXCRETA			X
CLASSIFICATION OF SOILS		X	
CLEARING/CLEARING AND RECLAMATION	X		X
COBALT			X
COMPLETE FERTILIZERS	X		
COMPOST	X		
COMPOUND FERTILIZERS			X
CONSERVATION OF SOIL,OF TOP-SOIL		X	
CONTOURING AND TERRACING	X		
CONTROL AND DUST AND WIND-DRIFT ON SAND		X	
CONTROL OF FLOODS AND EROSION		X	
CONVERTED HOUSEHOLD GARBAGE	X		
COPPER		X	
CROP ROTATION AND COVER CROPS	X		
DESERTS; ARID LAND. IRRIGATION			X
DRAINAGE/DRAINAGE AND DITCHING	X	X	
DRY FARMING		X	
DUNG AS NIGHT SOIL AS COMPONENTS		X	
DUST AND WEATHERING		X	
EROSION AND WEATHERING		X	
FARMYARD MANURES	X		X
FERTILITY OF SOILS		X	
FERTILIZER RESEARCH	X		
FERTILIZERS	X	X	
FERTILIZERS AND IMPROVEMENT OF THE SOIL			X
FERTILIZERS AND SOIL CONDITIONERS	X		
FERTILIZERS FOR SPECIAL CROPS			X
FIRE, EFFECTS OF, ON THE SOIL		X	
FOR CONTROL OF ACIDITY (CONDITIONERS)	X		
FOR CONTROL OF ALKALINITY (CONDITIONERS)	X		
FOR TEXTURE (CONDITIONERS)	X		
GAS CONTENT AND GAS MECHANICS	X		
GEOGRAPHICAL TREATMENT	X		
GREEN MANURES	X	X	
GUANO	X		X
HILLSIDE PLANTING			X

TERMS	SYSTEMS		
	DDC	BBC	LCC
HISTORICAL TREATMENT	X		
HUMUS		X	
HYDROLOGY OF SOILS AND IN AGRICULTURE		X	
INORGANIC	X		
INSPECTION; LEGISLATION AND ADMINISTRATION			X
IRRIGATION/IRRIGATION AND WATER CONSERVATION	X	X	
LIME AND GYPSUM/LIME AND MARL, GYPSUM, etc.		X	X
LIQUID MANURES AND FERTILIZERS		X	
MAGNESIUM		X	
MANGANESE			X
MANURES AND COMPOSTS		X	
MELIORATION, IMPROVEMENT, RECLAMATION, etc.			X
METHODS OF APPLICATION	X		
MICROBIOLOGY OF SOILS		X	
MINERAL AND METALLIC CONSTITUENTS		X	
MISCELLANEOUS: OTHER FERTILIZERS			X
MIXED FERTILIZERS		X	
MOISTURE AND HYDROMECHANICS	X		
MULCH TILLAGE	X		
NATURAL FERTILIZERS		X	
NITRATE FERTILIZERS	X	X	
NITRIFICATION	X	X	
NITRIFYING CROPS	X		
NITROGEN/NITROGEN AS COMPONENT		X	X
NITROGEN FERTILIZERS	X		
NUTRITIVE PRINCIPLES	X		
ORGANIC	X		
OXYGEN			X
PHOSPHATES		X	X
PHOSPHORUS		X	X
PHOSPHORUS FERTILIZERS	X		
PHYSICAL CHARACTERS. SOIL MECHANICS		X	
PHYSICS AND CHEMISTRY OF SOILS		X	
POTASH		X	X
POTASSIUM		X	X
POTASSIUM FERTILIZERS	X		
RECLAMATION OF LAND		X	
RESTORATION AND IMPROVEMENT OF SOIL		X	
SALINE SOILS			X
SAND-DRIFT AND CONTROL OF: AND OF SAND-DUNES		X	
SANITATION, STERILIZATION OF SOIL		X	
SELENIUM			X
SEWAGE SLUDGE	X		
SILTATION		X	
SODIUM	X		
SOIL ACIDITY			X
SOIL AND LAND USE SURVEYS	X		
SOIL AND SOIL CONSERVATION	X		
SOIL AERATION			X
SOIL BIOLOGY	X		
SOIL BIOCHEMISTRY			X
SOIL BORNE DISEASES		X	
SOIL CHEMISTRY	X		X
SOIL CLASSIFICATION	X		
SOIL COLLOIDS			X
SOIL CONDITIONERS	X		X
SOIL CONSERVATION			X
SOIL EROSION AND ITS CONTROL	X		
SOIL FERTILITY, ACIDITY, ALKALINITY	X		
SOIL FORMATION			X
SOIL INOCULATION	X		X
SOIL MICROMORPHOLOGY	X		
SOIL MOISTURE			X
SOIL PHYSICS	X		X
SOIL RECLAMATION AND DRAINAGE	X		
SOIL SCIENCE	X		
SOIL STRUCTURE			X
SOIL TEMPERATURE			X
SOIL TYPES	X		
SOILS			X
SOILS FOR AGRICULTURE		X	
SOILS FOR SPECIAL CROPS			X
SPECIAL METHODS AND SYSTEMS			X
SPECIFIC KIND OF FERTILIZERS	X		
STREAMBANK PLANTING			X
STRIPP CROPPING	X		
STUDY AND TEACHING			X
SULPHUR		X	X
SUPERPHOSPHATES	X		
TERRACING			X
THERMAL PHENOMENA	X		
TILLAGE AND ROTATION OF CROPS			X
TRACE ELEMENTS			X
USE OF FERTILIZERS			X
VEGETABLE FERTILIZERS			X
VEGETABLE MANURES AND OTHER ORGANIC FERTILIZERS	X		
WOODLANDS. CLEARING			X
Terms: 142	58	49	58

5. Conclusions

The results of the analyses allow us to draw some conclusions about the systems under qualitative and quantitative aspects.

5.1 Qualitative aspect

Under this aspect we group some observations on structure, relationships, inconsistencies and content.

a) Structure

The systems do not seem to have a scientific structure, or logical development.

b) Relationships

Material relationships between concepts were found to be most clearly expressed in DDC, maybe due to the flexibility of its notation. LCC and BBC do not show many relationships in this special subject field.

c) Inconsistencies

Inconsistencies are the common denominator of the systems. Examples were pointed out in the analysis of each system.

d) Content

The field is not treated exhaustively in any of the systems. These failings and lacunae became more clearly apparent in the attempt (to follow) to construct a new system on the basis of the elements of all the classification systems analyzed.

5.2 Quantitative aspects

According to the results of Tables 2 and 3 we may conclude:

a) DDC is more hierarchically organized than the other systems. Differences between BBC and LCC are not significant.

b) The list of terms for building a new system shows that of 142 terms, 58 are contained in DDC, 49 in BBC and 58 in LCC, giving percentages of 40.84%, 34.5% and 40.84% respectively, with respect to the total.

The excess over 100% represents the linguistic coincidences between the systems: 16.18%. This small percentage of coincidences emphasizes the different linguistic treatment applied to the same concepts. Quantitative differences of frequencies are not significant.

6. Proposal for a new structure

The following faceted classification of our special subject field is based solely on the concepts of the three systems analyzed*, however the results are not satisfactory due to absence of concepts, incomplete treatment of the field, lack of exhaustiveness in the genus-species relation, etc. It would be necessary to include concepts from other sources, in order to obtain the integration and subordination of elements necessary.

Sentences of the traditional systems were dissected to isolate the concepts in them and to win more flexibility. Synonymous terms were eliminated and conserved in order to make cross-references in the index.

Some principles were used in the array, such as the chronological one to determine the order of the operations. Hierarchical relationships are common in the structure.

An alpha-numerical notation was adopted and the oblique stroke (slash) was selected as the symbol of relation. The same symbol was used in the schedule for added terms.

The citation order is facilitated by the very structure of the system: kinds-parts-properties-operations and processes.

ACRICULTURAL SOIL SCIENCE

I Kinds, Soil classification
- b /By climate/
- bc Arid
- d /By constitution/
- dc Saline
- df Alkaline
- f /By texture/
- fc Sand
- h /By use/
- hc Agricultural
- hx Abandoned
- j /By position/
- jb Top-soil

2 Constituents and additions
- b Constituents
- bc Chemical
- bcb Inorganic
- bcbb Trace elements.
- bcbd Nitrogen
- bcbdb Nitrates
- bcbdf Ammonia
- bcbe Phosphorus
- bcbeb Phosphates
- etc.
- be Biological
- bec Microorganisms
- becd Bacteria
- e Additions
- eb Fertilizers
- ebc Fertilizers for special crops
- ebe Nitrogen
- ebeb Nitrates
- ebed Ammonia
- ebg Sodium
- ebi Potassium
- ebk Calcium
- ebkb Lime
- ebkd Gypsum
- ebm Phosphates
- ebmb Superphosphates
- ebo Compound fertilizers
- ed Manures
- edb Vegetable
- edbc Green
- ede Animal
- edec Animal industry remains
- edee Farmyard
- edeg Guano
- edei Human excreta
- ef Conditioners
- efb For control of acidity
- efbc Lime
- efbe Gypsum
- efd For control of alkalinity
- efdc Sulfur
- eff For texture
- effb /Peat/
- g Crops
- (divide by a crops schedule)

3 Properties
- b Physical
- bb Mechanics
- bd Moisture
- bf Temperature
- etc.
- d Chemical
- dc Acidity
- de Alkalinity
- etc.
- f Biological
- fb Fertility
- fm Nutritive principles

4 Actions, processes
- b Survey
- (divide by a geographical schedule)
- d Legislation
- db Inspection
- f Administration
- g Sanitation
- gb Diseases
- gd Sterilization
- i Reclamation, conservation, improvement by:
- ib Burning
- id Clearing
- ie Drainage
- ieb Dry farming
- ig Ditching
- ih Aeration
- ii Irrigation
- ik Terracing
- il Contouring
- im Tillage
- imb Mulch tillage
- in Siltation
- io Hillside planting
- ip Streambank planting
- iq Fertilization
- iqb Application
- iqbb /by/ Inoculation
- etc.
- m Analysis
- n Formation
- o Physical
- p Chemical

* This was due to the assignment followed (Ed. note).

q	Biological
r	Erosion
rb	/by/ Water
	etc.
s	Weathering
5	General
b	Study and teaching
e	Experiment
g	Research
i	Principles
m	Methods
o	Geographical treatment (divide by a geographical schedule)
q	Historical treatment (divide by a history schedule)

7. Application examples

The following examples should give an idea how the above proposed new structure may be used in classing some themes in Agricultural Soil Sicence:

Research in arid soils	1 bc/5g
Water erosion in agricultural lands	1 hc/4rb
Effects of temperature in chemical processes of the top-soil	1 jb/3bf/4p
Effects of soil acidity in crops	2g/3dc
Agricultural soil survey in Canada	1 hc/4b/50 (div.by geogr.sch.)

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