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INDIGENOUS KNOWLEDGE AND CLASSIFICATION OF SOILS: A CASE STUDY OF JABAL AL-AKHDAR, NORTH EAST LIBYA

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ABSTRACT

A growing number of studies have focused on the importance and usefulness of indigenous soil taxonomies as they relate to agricultural production. Drawing upon a dissertation on indigenous soil taxonomies, this article describes the farmers indigenous soil classification system at Jabal Al-Akhdar of northeast Libya. The study was carried out in two sites; the first is located at Shahat area (about 20 km. east Al-Beida city) dominated by Hassa tribe, while the second is located at Qassr El-Mekdem area (about 40 km. West Al-Beida city) and dominated by Hassana tribe. A total of 50 male household heads were interviewed and data were collected using participatory rural appraisal (PRA) techniques and community-based transect-mapping. Six soil profiles were selected to characterize different kinds of soils presented in study sites based on farmer's indigenous soil knowledge. Different soil types identified by local farmers are based on soil characteristics such as color, depth, stoniness and geographical location. Farmers from both villages identified 4 main types of soils in the first level of classification based on soil color. The farmers observed 10 types of soils based on color and depth in the second level of classification. Finally, based on color, depth and stoniness, a total of 30 types of soil at the third level of classification were observed by farmers.

INTRODUCTION

The importance of indigenous knowledge is receiving considerable attention in recent years in term of social and agriculture development (UNCED, 1992). Indigenous people and their local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development (Pawluk et al., 1992; Hayashi et.al.,2000ab). However, most of information about indigenous knowledge is oral patrimony from generation to generation and is different from tribes or regions (Ishida et. al., 1998; Hayashi et.al.,2000b). Indigenous knowledge can be defined as accumulated knowledge, skill and technology of local people derived from their direct interaction with the environment (Altieri 1990). Information is passed on through generations and refined into a system of understanding the natural resources and relevant ecological processes (Pawluk et al. 1992).

Indigenous knowledge about soil encompasses many aspects, including indigenous perceptions and explanations of soil properties and soil processes, soil classifications, soil management, and knowledge of soil-plant interrelationships (Williams & Ortiz-Solorio 1981, Hecht 1990). Local soil classification has been the centeral focus of majority of the studies undertaken worldwide to understand farmers' local knowledge about their soils. According to the bibliography of Barrera-Bassols and Zink (2000), over half of the ethnopedology studies focus on soil classification (Niemeijer and Mazzuczto, 2003). For variety of reasons, the focus on local soil classification continues to be the main feature of the recent studies on local soil knowledge (Shrestha *et al.*, 2004). Firstly, there has been increasing recognition of farmers' local soil knowledge, and practical benfits of local soil classification (Niemeijer, 1995; Talawar and Rhoades, 1998; Niemeijer and Mazzuczto, 2003). Local soil classifications are faster and cheaper compared to the traditional scientific soil surveys; it can offer important insight into local use and perceptions of soils in relation to agricutlreal production; and it can considerably facilitate communication between farmers, development workers and researchers (Niemeijer, 1995). Secondly, local soil classification or nomenclatures have been very convenient entry point in understanding local soil knowledge (Niemeijer and Mazzuczto, 2003). It provides useful reference when discussing with farmers about their soil knowledge. Thirdly, increased interest of researchers and development professionals from a wide range of disciplines including soil scientists, agronomists and socioeconomists, has added new dimensions – scientific validation and utility – to the studies on local soil classification (Shrestha *et al.*, 2004). Recently a great deal of research has focused on the importance and usefulness of soil taxonomies as they relate to agricultural production (McMillan, 1980; Dvorak, 1988; Osunade, 1988; Kerven and Sikana, 1988; Dolva *et al.*, 1988; Behrens, 1989; Tabor, 1990).

Indigenous soil classifications are found throughout the world, and have been documented for peoples in Latin America, Southeast Asia, and Africa. They form the basis for many management practices, such as the fine attunement of cropping systems to the agricultural capabilities of the site, and adjusting soil conservation practices (Weinstock 1984, Marten & Vityakon 1986, Pawluk *et al.* 1992). Evidence indicates, however, that the African farmers have an extensive knowledge of their soil. Local soil taxonomy is based on soil characteristics as they relate to specific crops and, traditionally, provides the insight and ecological knowledge required for making good use of available agricultural resources (Richards, 1985). While inquiry on indigenous soil taxonomies is expanding, it is noticeable that a limited number of field studies have been conducted in the Arab countries such as Briggs et al, 1998; Moustafa, 2001 and Zurayk et al, 2001.

Ettema (1994), discussed and differentiated between physical and perceptual dimensions of indigenous soil classification. The 'physical' dimension concerns the most readily observable criteria that farmers use to differentiate their soils, namely soil characteristics that can be discerned by sight, feel, taste or smell (Osunade 1992). The two most obvious physical characteristics of soil, which are texture and color, are 'inescapable' and found to be the basis of many indigenous soil classifications throughout the world. Criteria of the 'perceptual' dimension are not as concrete as those in the physical dimension nor are they always readily recognized (through the senses) as soil characteristics. Examples are soil workability, suitability classes for certain crops, sensitivity classes to certain agricultural problems, and non-agricultural classes based upon the use of soil as building and pottery material (Ettema, 1994).

The objective of this work is to identify indigenous soil classification system used by the farmers in two selected areas and two different tribes in Jabal Al-Akhdar of North East Libya and attempts to identify the local diagnostic criteria for differentiating soil types as well as to explain how indigenous knowledge of soils has been applied to land use.

STUDY AREA

Jabel Al-Akhdar occupies the greatest part of Northern Cyrenaica and is roughly 250 km long parallel to Mediterranean coast, the ground falls away very gradually to the south and the east but two steep escarpments delineate the northern part. All the exposed rocks are sedimentary and mainly marine limestone. The oldest is Cretaceous and the youngest is Marine Pleistocene, but most of the area may be regarded as composed of Eocene with subsidiary Miocene. The Jabel Al-Akhdar is a mountainous region, which consists of plateaus running parallel to the seashore. The lower lying plateau has an elevation between 200-400 m. The upper plateau, whose elevation varies from 400-700 m. is extended southward by a higher zone with a gradual transition and reaches 876 m. at its highest point; this latter zone is sometimes called the third plateau (Hubert, 1964 and FAO, 1973). The upper plateau is characterized by ferro-siallitic soils (Alfisols), rendzinic or brown limestone soils (Mollisols or Inceptisols), or very clayey vertic soils (Vertisols). The landscape consists of hills covered with vegetation like *Pistacia lentiscus, Oleasters sp, Cypressus phlomis, Cistus sp* and *Artemisia herba alba*. The lower plateau is characterized by clay terra rossa and ferro-siallitic soils (Alfisols). This plateau is covered by *Juniperous phoenicea, Pistacia lentiscus* and *Oleasters sp*. (Selkhozprom Export, 1980). The area characterized by Mediterranean climate. The average rainfall is greater than 500 mm. and the average temperature is 18^{o}. The cultivated crops includes grapes, almonds, figs, olives, barely, wheat and vegetables (Abdel-Wahed *et al*, 1978)

MATERIAL AND METHODS

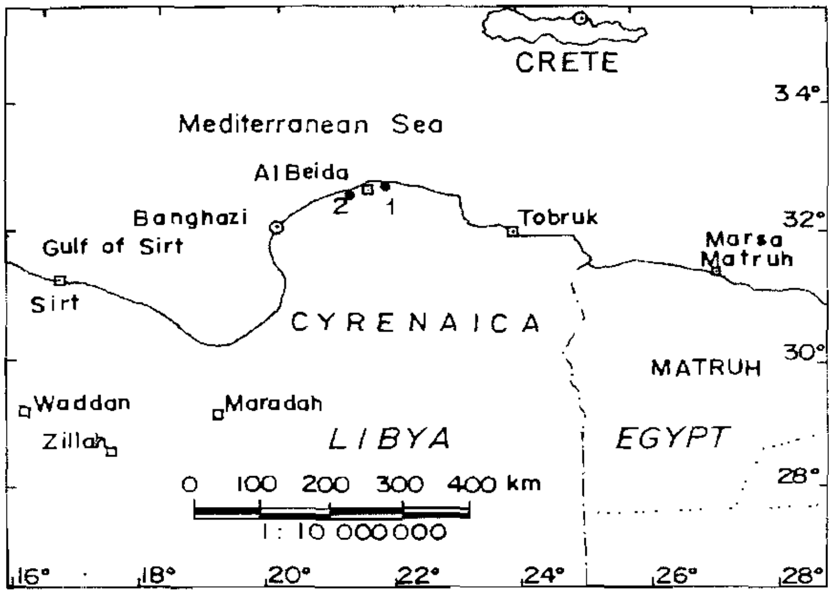
Study sites:

The study was carried out in two sites. The first one is located at Shahat area (1), about 20 km east Al-Beida city, with coordinates 32° 49' 53" N and 21° 53' 67" E, elevated to about 640 m A.S.L., and inhabited by Hassa tribe. The second site is located at Qassr El-Mekdem area (2), about 40 km. West Al-Beida city, with coordinates 32° 38' 15" N and 21° 30' 25" E, elevated to about 415 m. A.S.L. and populated by Hassana tribe (Map1).

Community-based transect-mapping:

Transect mapping, or "walk through", is a system of mapping in which the resulting soil resources information is presented in a cross matrix or as transects with illustrations of objects that are visible on the soil surface (Concepcion and Batjes, 1997). Data were collected using participatory rural appraisal (PRA) techniques with men farmers (Kauffman, 1997) and the *method of documenting local* knowledge involved focus groups discussion with separate groups of farmers with direct and visual reference to a large number of soil samples, representing largest possible soil variations, collected from different parts of the village. It involved discussion with farmers about the way they recognize variation in soils, their knowledge about the nature and properties of these soils, and the framework or basis they adopted in grouping similar soils in different soil categories. Farmers were used the basic human senses – sight, touch and hearing – in identifying soil attributes useful for the classification of soils and for making their farm decisions (Concepcion and Batjes, 1997). Small-scale farmers from the two selected areas (Shahat and Qassr El-Mekdem) composed the target population. A total of 50 male household heads were interviewed. They were asked to:

- name the different types of landscape on their land;
- name the different types of soil on their land;
- indicate the characteristics associated with each type of soil; and
- indicate specific crops that grow well on each type of soil.



Map 1: Location of the study sites

Soil sampling and analysis

Six soil profiles were selected to characterize different kinds of soils presented in study sites. Soils were sampled based on farmers indigenous soil knowledge and land use types. Soil profiles were morphologically described in the field according to the FAO (1990), and soil samples were collected for laboratory determinations. The soil samples were analyzed for chemical and physical characteristics, including salinity, pH, total calcium carbonate, cation exchange capacity, organic matter, total nitrogen, available phosphorous and potassium and texture (Page *et al.*, 1982).

RESULTS AND DISCUSSION

Farmers and natural senses

The main observation, identification and finding of the farmers were based on their natural senses, such as sight, hearing and touch. In the fact, these senses are very important not only to the farmers, but also to soil surveyor and soil scientists. The farmers in the study sites used their senses in the following manner:

Sight: many soil properties involved in indigenous soil determination are visible to eyes (Osunade, 1988). The most important of those is soil color, being used throughout many descriptions around the world (Ettema, 1994). Generally, farmers believed that dark soil is more fertile than light ones (Zurayk et al, 2001). Farmers differentiate soils based on color, as they prefer dark colored soils, which reflect higher content of organic matter (Mollic epideon of *Mollisols*). A dark color soil is often associated with *Vertisols*, and some categories of *Alfisols*, which are high in clay content and water holding capacity. Light colored soils are often associated with exposed calcareous parent rock, low organic matter and low water holding capacity. Farmers in the study area recognize the elevation and topography and they could classify their land into different types of physiographic features. Depressions, Wadis and gentle slopes are the most important and usable units in their agricultural activities. This classification based on match up to some parts of human and animal bodies like head, neck, throat, belly, back, leg and tail. Actually, we did not found this type of matching in any available pervious studies.

Touch: it is involved in assessing soil texture, based on rubbing soil between two fingers to distinguish the texture class (Ettema, 1994 and Concepcion and Batjes; 1997). Texture in the studied sites is mostly skewed near fine texture. Farmers do not use texture as base of classification because its high similarity on the different soils. Otherwise, they use touch to measure the size and weight of rock fragments. On this basis, they could classify rock fragments into coarse and medium size. In addition, they use their feet to detect the fine rock fragments when they walk over soil and gave sound like crisp.

Hearing: sound is an important indicator of biodiversity in the rural areas (Concepcion and Batjes; 1997). Farmers used the sound of rubbing stones and rock fragments during tilling their lands as indicator of stoniness. It reflects both of rocks size and abundance based on the degree of noisy during tilling.

Knowledge about landscape and its relation to human and animal bodies: Farmers have different terms to different soil types, landscape and slope segments. Jabal Al-Akhdar farmers recognize different landscape and slope profiles running through the studied sites (Figures 1 and 2). Farmers used two expressions to describe the moderate and steep slopes based on the direction of their movement over these slopes. If their movement from down to upper slope, they named it *Ssouda* "the nearest literal meaning could be ascension". On the other direction, they named the slope as *Dardoha* "the nearest literal meaning could be descendant".

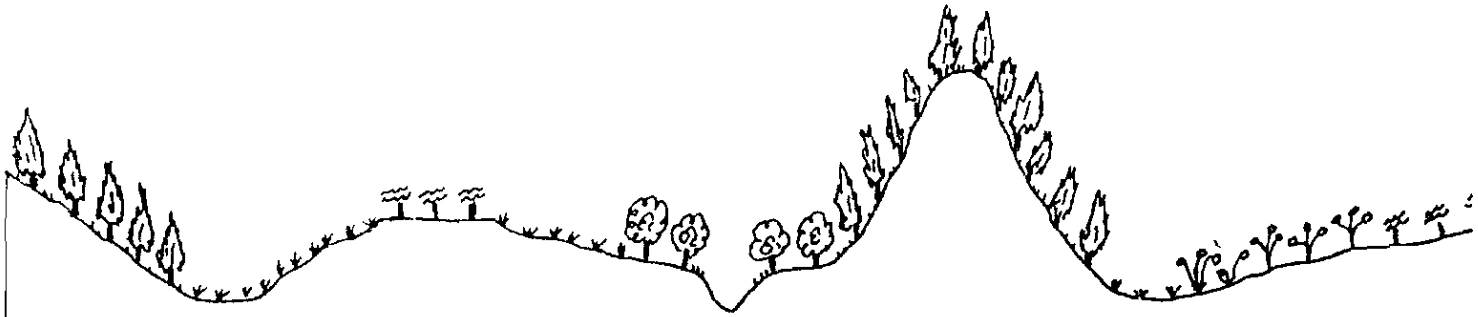
Farmers use human body to correspond with observed landscape. According to this classification, a typically flat hill crest would be called *E'thhara* , which simply means back. Likewise, *Batten* means literally salient belly and topographically hillcrest.

Halg means literally throat and its equal to very narrow wadi, while, *Ragba* means neck and refers to small wadi. Also, *Saag* means leg and equivalent to simple slope. In the same way, they used *Rass* (literally head) to describe begin of any landscape feature like Rass Al-Wadi, which means begin of the Wadi system. The animal body is used for some features, like the end of any landscape feature could be called *thail,* which literally means tail. Farmers used *E'Deppeka* (literally hornless head) to designate the flat hillcrest.

This way of similitude landscape with human body revealed how farmers try to use simple and acceptable nomenclature to their environmental features. There was a common understanding among the farmers that soils under any degree of slope except that of the plain are subject to erosion, commonly by heavy rain. The presence of soil deposits at the base of a slope, the outcropping or protrusion of rocks or stones on the soil surface and cracking of the soil were the key indicators of soil erosion given. Farmers in the study area generally attributed soil erosion in their fields to two factors, namely; the lack or absence of trees and other vegetative cover on the hilltops and hillsides, and heavy rainfall in the area especially during the rainy season

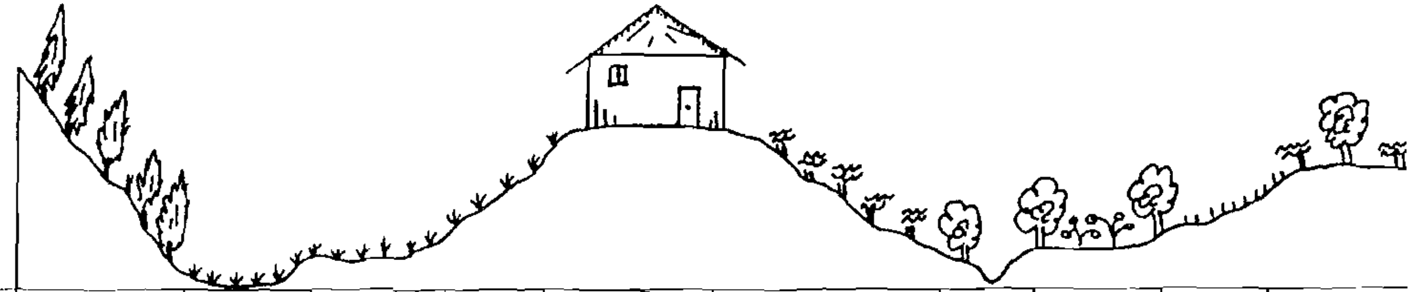
Knowledge about variations in soil and soil nomenclature system:

Farmers at the two research sites were quite knowledgeable about the variation in soils found in their land as well as that found around the village. They observed and noted about 11 physical properties and other soil features to recognize variation between their soils (Table1). Three of these are used for identifying and/or classifying attributes that are used to label or name and classify soils into identifiable soil types, while the other 8 are used to describe their properties as property attributes. From the identification/classification of soil attributes, soil color was the most commonly used to identify and name the soils, followed by depth and stoniness. Using combination of attributes for naming a particular soil was also very common. The property attributes included water characteristics, fertility, suitability and erodibility. Farmers also possessed a good knowledge about the ways in which identifying/classifying attributes affected crop production.



Indigenous landscape	*Dardoha* (Downward slope)	*Wadi* (Wadi)	*Srouda* (Upward slope)	*E'Thhara* (Back / Flat hill crest)	*Dardoha* (Down-ward slope)	*Halg Wadi* (wadi terrace)	*Sail* (Main water stream)	*Halg Wadi* (wadi terrace)	*Baaten* (Salient stomach / Hill) *Srouda* (Upward slope)	*Baaten* (Salient stomach / Hill) *Dardoha* (Downward slope)	*Saag* (Leg) Footslope	*Thail Al-Raggba* (Neck tail) Down slope	*Raggba* (Neck) Middle slope	*Rass Al-Raggba* (Neck head) Upper slope
Elevation (m.a.s.l.)	552-636	636-637	637-644	644	644-640	640	640-632	632-639	639-668	668-635	635-636	636-638	638-640	640-644
Indigenous soil name	*E'Shahaba Ragiga* (Shallow gray)	*Hamra Ragiga* (Shallow red)	*E'Shahaba Ragiga* (Shallow gray)	*Sawda Ragiga* (Shallow black)	*E'Shahaba Ragiga* (Shallow gray)	*Gahweya Ghariga* (Deep brown)	*Hajarlya* (Stony)	*Gahweya Ghariga* (Deep brown)	*E'Shahaba Ragiga Hajif* (Very shallow gray)	*E'Shahaba Ragiga Hajif* (Very shallow gray)	*Gahweya Ghariga* (Deep brown)	*Sawda Ghariga* (Deep black)	*Sawda Ghariga* (Deep black)	*Sawda Metaffla* (Shallow black)
Land use	Forests: *Juniperus Phoenicea Pitacia Lentiscus Arbutu Pavarii*	Cereals Barley	Cereals Barley	Orchards: Grape	Cereals. Barley	Orchards: Olives Figs Almonds Pomegranate	Non	Orchards: Olives Figs Almonds Pomegranate	Forests: *Juniperus Phoenicea Pitacia Lentiscus Arbutu Pavarii*		Cereals: Barley	Orchards: Apples		Orchards: Grape
Indigenous land suitability & fertility	*Ampa* (Poor)	*Semha* (Good)	*Bel Hoon* (Marginal)	*Semha* (Good)	*Bel-Hoon* (Marginal)	*Gaweya* (strong)	*Attipa* (Poor)	*Gaweya* (strong)	*Attipa* (Poor)	*Attipa* (Poor)	*Gaweya* (strong)	*Gaweya* (strong)	*Gaweya* (strong)	*Semha* (Good)
Erodibility	High	Low	Medium	Low	Medium	Low	High	Low	High	High	Low	Low	Medium	Medium

Figure 1 Community-based landscape transect at Shahat site



Indigenous Landscape	*Dardoha* (Downward slope)	*Mangaa* (Depression/ swampy in winter)	*Wadi* (Wadi	*Ssouda* (Upward slope)	*E'Deppeka* (Flat top of hillock)	*Dardoha* (Downward slope)		*Sail* (Main water stream)	*Wadi* (Wadi	*Ssouda* (Upward slope)	*Battha* (Flat ground)
Elevation (m.a.s.l.)	430-414	412-414	414-416	416-425	425	425-412		408	412-413	413-415	415
Indigenous soil name	*Hamra Ragiga* (Shallow red)	*Sawda Ghariga* (Deep black)	*Hamra Ragiga* (Shallow red)	*E'Shahaba Ragiga* (Shallow gray)	*Goara* (Man-levelling)	*E'Shahaba Ragiga* (Shallow gray)	*Hamra Ragiga* (Shallow red)	*Hajariya* (Stony)	*Sawda Ghariga* (Deep black)	*Hajariya* (Stony)	*Hamra Ragiga* (Shallow red)
Land use	Forests *Juniperus phoenicea Pitacia lentiscus Arbutu pavarii*	Cereals: Wheat	Cereals Barley	Cereals: Barley	House	Orchards: Grape	Orchards Almonds	Non	Orchards: Apples Prune Peach	Shrubs: *Sarcopoterium spinosum*	Orchards: Grape Figs
Indigenous land suitability & fertility	*Attipa* (Poor)	*Gaweya* (Strong)	*Semha* (Good)	*Bel-Hoon* (Marginal)	Not relevant	*Semha* (Good)	*Semha* (Good)	*Attipa* (Poor)	*Semha* (Good)	*Attipa* (Poor)	*Semha* (Good)
Erodibility	High	Low	Low	Medium	Not relevant	Medium	Low	High	Low	High	Low

Figure 2: Community-based landscape transect at Qasr El-Mekdem site

Table (1): Soil Attributes recognised and used by farmers in identifying/classifying soils and describing their properties

Categories of soil attributes	Soil attributes	Terms and values used to describe attributes
Classifying attributes	1- Soil color	*Hamra* (red), *Sawda* (black), *Gahweya* (brown), and *E'Shahaba* (Gray)
	2- Soil depth	*Ghariga* (deep), *Ragiga* (shallow), *Hajif* (very shallow), and *Taga* (rock outcrops)
	3- Soil Stoniness	*Gaweya* (non stony), *Hait* (stones >16mm), *Gazz* (stones 16-8mm), and *Garmasha* (stones <8mm "sound like crisp")
Property attributes	1- land suitability and fertility	*Gaweya* (strong or highly suitable), *Semha* (good or moderately suitable), *Bel Hoon* (minimum or marginally suitable), and *Attipa* (poor or not suitable)
	2- Soil texture	*Naamaa* (fine) and *Kheshnaa* (coarse)
	3- Water infiltration	High, Medium and Low
	4- Wetting rate	High and Low
	5- Drying rate	High and low
	6-Manure requirement	High and Medium
	7- Erodibility	High, Medium and Low
	8- Crop suitability	Examples: *Sawda Ghariga* (deep black) good for all types of cultivation such as apple, grape, prune, peach and cereals *Hamra Ghariga* (deep red) good for apple, prune and peach "based on manure" *Sawda Ragiga* (shallow black) good for grape *Hamra Ragiga* (shallow red) good for barley

Framework for indigenous classification system:

Farmers soil classification system is based largely on color, depth and stoniness, which is comparable to technological classification systems. Interviews and discussions with local people at Jabal Al-Akhdar revealed clearly that when they talk about a particular soil type they are referring to the soil as observed, in terms of its surface characteristics first, then followed by subsurface characteristics. There are three basic principles behind the framework of the indigenous farmer's classification (Table 2):

1- Soil names start with the formative element '*Torpa*' which literally means soil.

2- '*Torpa*' is then followed by one or more adjectives, which describe the type of soil in terms of their properties, which include:

a- Color-based soil classification: This system of classification was commonly used especially in day-to-day communication and was easily constructed from the names given to soils by farmers. It gives an indication of soil fertility status and identifies or locates a particular soil in an area, but not provide any systematic basis for understanding other associated soil properties (Shrestha et. al.,2004). According to this classification four main soil color class were identified. A typically red soil would be called *Torpa Hamra*, which simply means red soil. Likewise, *Torpa Sawda* or *Zarga* means dark or black soil and *Torpa E'shahaba* means gray soil. Also, *Torpa Gahweya* means brown soil. in addition, farmers sometimes follow color by the degree of darkness, like *Torpa Hamra Ghamga* means dark red soil.

b- **Depth-based soil classification**: A shallow soil would be called *Torpa Ragiga*, whereas *Torpa Ghariga* is typically a deep soil. *Torpa Hajif* or *Taga* is very shallow or rock outcrops, respectively. The classification based on soil depth and was derived from farmers' practices during digging cistern, wells and plowing. Actually, it's important for the differentiation between land suitability for trees (orchards) and field crops (cereals).

c- **Stoniness-based soil classification**: This system was derived from the field practices, as experienced by farmers while tilling the soil. The term *Gaweya* (strong) refers to non-stony soil and used also for fertile or highly suitable soil. Farmers soil stoniness is related to the size of rock fragments not the abundance. *"Hait"* refers to rock fragments larger than 16 mm, likewise, *"Gazz"* means rock fragments between 16 and 8 mm, while, *"Garmasha"* refers to the crisp sound resulted from walking over rock fragments less than 8 mm in size.

3- The final indigenous soil classification name contains the combination between the previous three classification attributes respectively.

Farmers from both villages identified 4 main types of soils in the first level of classification based on soil color (Table 2). The farmers observed in the second level of classification 10 types of soils based on combination between color and depth. Finally, based on combination between color, depth and stoniness, a total of 30 types of soil at the third level of classification were observed by farmers. Comparing the two villages and two tribes, it appears that there is no difference between their indigenous soil and landscape classifications. This similarity is due to living in the same geographical zone and ecological environment.

Farmers decide the best use for their land based on their knowledge of soil types. For example, they attribute a high fertility status to *"Sawda Ghariga"* because it has a dark color, deep soil, feels humid because of its high organic and clay content, and is easy to plough. These observations are in accordance with results from laboratory analysis (Table 3 and 4). Data show that surface horizons of black soils (profiles 2 and 3) have texture varied between clay loam to clay and highest values of organic matter (3.68% and 3.72%), cation exchange capacity (45.40 to 56.25 Cmole/kg) and nutrient statues (NPK). Thus they use it for wheat, barley, apples, grapes and all other crops. Another example is *'E'shahaba Ragiga'* (profile 5), where the farmers observe this type of soil as non-fertile, shallow and sometimes mixed with calcareous shale. Data in tables 3 and 4 show that profile 5 has light color, highest carbonate contents (58 to 66.9%), low cation exchange capacity, lowest nitrogen contents (0.09 to 0.04%) and low phosphorus content, and hence, it is best suited for barley or green grazing. The farmers put soils which they judge to be unfit for agricultural production to other uses. For example, the very shallow soils *"E'shahaba Ragiga Taga* or *Hajif"* are used for natural forests. Farmer's evaluation was confirmed by the results from laboratory analysis as shown in Tables 3 and 4, and matched with the information derived from indigenous knowledge. Such a pragmatic soil classification allows Jabal Al-Akhdar farmers to make an appropriate use of

Table (2): Indigenous Soil Classification by Farmers.

Level 1 Based on color	Level 2 Based on color and depth	Level 3 Based on color, depth and stoniness
Torpa Hamra (Red Soil)	*Torpa Hamra Ragiga* (Shallow Red Soil)	*Torpa Hamra Ragiga Gaweya* (Shallow Red Soil Without Rock Fragments) *Torpa Hamra Ragiga Hait* (Shallow Red Soil With Rock Fragments > 16mm) *Torpa Hamra Ragiga Gazz* (Shallow Red Soil With Rock Fragments 16-8mm) *Torpa Hamra Ragiga Garmasha* (Shallow Red Soil With Rock Fragments < 8mm)
	Torpa Hamra Ghamga Ragiga (Shallow Dark Red Soil)	*Torpa Hamra Ghamga Ragiga Gaweia* (Shallow Dark Red Soil Without Rock Fragments) *Torpa Hamra Ghamga Ragiga Hait* (Shallow Dark Red Soil With Rock Fragments > 16mm) *Torpa Hamra Ghamga Ragiga Gazz* (Shallow Dark Red Soil With Rock Fragments 16-8mm) *Torpa Hamra Ghamga Ragiga Garmasha* (Shallow Dark Red Soil With Rock Fragments < 8mm)
	Torpa Hamra Ghamga Ghariga (Deep Dark Red Soil)	*Torpa Hamra Ghamga Ghariga Gaweya* (Deep Dark Red Soil Without Rock Fragments) *Torpa Hamra Ghamga Ghariga Hait* (Deep Dark Red Soil With Rock Fragments > 16mm) *Torpa Hamra Ghamga Ghariga* Gazz (Deep Dark Red Soil With Rock Fragments 16-8mm) *Torpa Hamra Ghamga Ghariga Garmasha* (Deep Dark Red Soil With Rock Fragments < 8mm)
Torpa Sawda (Black soil)	*Torpa Sawda Ghamga Ragiga* (Shallow Dark Black Soil)	*Torpa Sawda Ghamga Ragiga Gaweya* (Shallow Dark Black Soil Without Rock Fragments) *Torpa Sawda Ghamga Ragiga Hait* (Shallow Dark Black Soil With Rock Fragments > 16mm) *Torpa Sawda Ghamga Ragiga Gazz* (Shallow Dark Black Soil With Rock Fragments 16-8mm) *Torpa Sawda Ghamga Ragiga Garmasha* (Shallow Dark Black Soil With Rock Fragments < 8mm)
	Torpa Sawda Ghamga Ghariga (Deep Dark Black Soil)	*Torpa* Sawda Ghamga *Ghariga Gaweya* (Deep Dark Black Soil Without Rock Fragments) *Torpa Sawda Ghamga Ghariga Hait* (Deep Dark Black Soil With Rock Fragments > 16mm) *Torpa* Sawda Ghamga *Ghariga Gazz* (Deep Dark Black Soil With Rock Fragments 16-8mm) *Torpa Sawda Ghamga Ghariga Garmasha* (Deep Dark Black Soil With Rock Fragments < 8mm)
	Torpa Sawda Mettaffla (Shallow Black Soil mixed with Calcareous shale)	*Torpa* Sawda *Mettaffla Hait* (Shallow Black Soil mixed with Calcareous shale and Rock Fragments > 16mm) *Torpa Sawda Mettaffla Gazz* (Shallow Black Soil mixed with Calcareous shale and Rock Fragments 16-8mm) *Torpa Sawda Mettaffla Garmasha* (Shallow Black Soil mixed with Calcareous shale and Rock Fragments < 8mm)
Torpa E'Shahaba (Gray Soil)	*Torpa E'Shahaba Ragiga* (Shallow Gray Soil)	*Torpa E'Shahaba Ragiga Hait* (Shallow Gray Soil With Rock Fragments > 16mm) *Torpa E'Shahaba Ragiga Gazz* (Shallow Gray Soil With Rock Fragments 16-8mm) *Torpa E'Shahaba Ragiga Garmasha* (Shallow Gray Soil With Rock Fragments < 8mm)
	Torpa E'Shahaba Ragiga Taga or *Hajif* (Very Shallow Gray Soil)	Not classified in this level
Torpa Gahweya (Brown soil)	*Torpa Gahweya (Mekhalata) Ragiga* Shallow Brown "Mixed" Soil)	*Torpa Gahweya (Mekhalata) Ragiga Gazz* (Shallow Brown "Mixed" Soil With Rock Fragments 16-8mm) *Torpa Gahweya (Mekhalata) Ragiga Garmasha* (Shallow Brown "Mixed" Soil With Rock Fragments < 8mm)
	Torpa Gahweya (Mekhalata) Ghariga (Deep Brown "Mixed" Soil)	*Torpa* Gahweya *(Mekhalata) Ghariga Gazz* (Deep Brown "Mixed" Soil With Rock Fragments 16-8mm) *Torpa Gahweya (Mekhalata) Ghariga Garmasha* (Deep Brown "Mixed" Soil With Rock Fragments < 8mm)

Table (3): Some morphological and physical characteristics of studied soil profiles

Prof. no	Depth, cm.	Color	Particle size			Texture class
			Sand	Silt	Clay	
Torpa Hamra Ragiga Gazz *(Shallow Red Soil With Rock Fragments 16-8mm)*						
1	0-20	Reddish brown (5YR4/4 dry)	49.0	38.0	13.0	Loam
	20-45	Reddish brown (5YR4/4 dry)	40.0	32.0	28.0	Clay loam
Torpa Sawda Ghamga Ragiga Gazz *(Shallow Dark Black Soil With Rock Fragments 16-8mm)*						
2	0-15	Very dark grayish brown (10YR3/2 dry)	30.0	25.0	45.0	Clay
	15-40	Very dark grayish brown (10YR3/2 dry)	35.0	30.0	35.0	Clay loam
Torpa Sawda Ghamga Ghariga Gaweia (Deep Dark Black Soil Without Rock Fragments)						
3	0-20	Dark grayish brown (10YR4/2 dry)	37.0	36.0	27.0	Clay loam
	20-45	Dark grayish brown (10YR4/2 dry)	27.0	21.0	52.0	Clay
	45-70	Very dark grayish brown (10YR3/2 dry)	31.0	24.0	45.0	Clay
	70-100	Very dark grayish brown (10YR3/2 dry)	23.0	26.0	51.0	Clay
	100-130	Dark brown (10YR4/3 dry)	33.0	28.0	39.0	Clay loam
Torpa Sawda Metaffela Hait *(Shallow Black Soil mixed with Calcareous shale and Rock Fragments > 16mm)*						
4	0-15	Dark brown (10YR4/3 dry)	31.0	54.0	15.0	Silt loam
	15-45	Dark grayish brown (10YR4/2 dry)	35.0	58.0	7.0	Silt loam
Torpa Shahaba Ragiga Gazz *(Shallow Gray Soil With Rock Fragments 16-8mm)*						
5	0-20	Grayish brown (10YR5/2 dry)	59.0	32.0	9.0	Sandy loam
	20-45	Light brownish gray (10YR6/2 dry)	53.0	24.0	23.0	Sandy clay loam
Torpa Gahweya Ghariga Garmasha *(Deep Brown "Mixed" Soil With Rock Fragments < 8mm)*						
6	0-25	Brown (7.5YR5/2 dry)	37.0	46.0	17.0	Loam
	25-55	Brown (7.5YR5/2 dry)	39.0	34.0	27.0	Clay loam
	55-75	Dark brown (7.5YR4/4 dry)	41.0	36.0	23.0	Loam

Table (4): Some chemical properties of studied soil profile

Prof. no	Depth, cm.	pH	E.C., dS/m	$CaCO_3$ %	O.M. %	Exchangable cations, Cmole/kg				C.E.C. Cmole/kg	Nutrient status		
						Ca	Mg	Na	K		Tot. N, %	Av.P, p.pm.	Av. K, p.p.m.
Torpa Hamra Ragiga Gazz *(Shallow Red Soil With Rock Fragments 16-8mm)*													
1	0-20	8.21	0.22	25.0	2.95	25.24	15.36	0.06	1.00	41.66	0.21	2.30	129.0
	20-45	8.30	0.22	23.0	2.37	19.26	13.28	0.15	0.67	33.35	0.16	1.20	58.0
Torpa Sawda Ghamga Ragiga Gazz *(Shallow Dark Black Soil With Rock Fragments 16-8mm)*													
2	0-15	8.12	0.25	14.8	3.68	36.90	7.50	0.20	0.80	45.40	0.28	2.50	156.0
	15-40	8.14	0.27	23.4	2.31	34.10	6.90	0.20	0.50	41.70	0.22	1.10	121.0
Torpa Sawda Ghamga Ghariga Gaweia (Deep Dark Black Soil Without Rock Fragments)													
3	0-20	8.14	0.27	17.8	3.72	32.51	5.22	0.22	1.03	38.98	0.32	4.20	160.0
	20-45	8.24	0.25	20.0	2.25	43.26	12.00	0.14	0.85	56.25	0.21	3.00	150.0
	45-70	8.46	0.22	17.8	2.01	37.16	7.22	0.13	0.69	45.20	0.16	2.30	150.0
	70-100	8.42	0.22	6.7	1.83	39.92	7.29	0.13	0.75	48.09	0.11	0.70	124.0
	100-130	8.45	0.22	12.0	1.20	22.13	25.84	0.22	0.64	48.83	0.08	0.30	120.0
Torpa Sawda Metaffela Hait *(Shallow Black Soil mixed with Calcareous shale and Rock Fragments > 16mm)*													
4	0-15	8.12	0.70	50.0	2.19	20.43	17.64	0.24	0.85	39.16	0.20	3.50	140.0
	15-45	8.22	0.51	50.0	2.00	19.36	18.10	0.26	0.51	38.23	0.13	0.80	98.0
Torpa Shahaba Ragiga Gazz *(Shallow Gray Soil With Rock Fragments 16-8mm)*													
5	0-20	8.19	0.27	58.0	1.97	20.84	12.53	0.15	0.55	34.07	0.09	2.00	141.0
	20-45	8.29	0.24	66.9	0.98	16.66	16.58	0.14	0.36	33.74	0.04	0.50	71.0
Torpa Gahweya Ghariga Garmasha *(Deep Brown "Mixed" Soil With Rock Fragments < 8mm)*													
6	0-25	8.16	0.28	31.2	3.21	24.68	16.11	0.14	1.29	42.22	0.18	2.30	121.0
	25-55	8.29	0.23	33.9	2.80	23.72	2.25	0.14	0.82	26.93	0.12	0.60	118.0
	55-75	8.39	0.22	16.0	2.10	20.18	17.13	0.15	0.76	38.22	0.08	0.30	118.0

their land, by associating specific crops with specific soil types on which these crops grow and thrive particularly well.

From the above-mentioned results, it can be seen that the indigenous soil classification system of Jabal Al-Akhdar farmers' is based on various soil characteristics such as color, depth, stoniness and geographical location. In this respect Jabal Al-Akhdar farmers' indigenous soil classification system is comparable with indigenous soil taxonomies elsewhere reported in the literature (Acres, 1984; Osunade, 1988; Kerven and Sikana, 1988; Dialla, 1993; Briggs *et al*, 1998; Moustafa, 2001 and Zurayk *et al*, 2001).

The indigenous soil taxonomy is not only useful to the farmers, but also could serve as a guiding complementary tool to scientifically based systems. However, many soil surveys have ignored the indigenous soil classification (Tabor, 1990). Evidence indicates that soil scientists may gain insights if they get acquainted with the local indigenous soil classification system. Acres (1984) indicated that the results of systematic soil survey could be related to the soil *nomenclature* used by local farmers and their assessment of soil suitability for cultivation. In addition, the use of local names helps to alleviate the language barriers between administrators, planners, soil specialists, agriculturalists and farmers.

CONCLUSIONS

The findings discussed above show that farmers possess good knowledge about variations in soils, and name them to reflect such variations. However, the naming and classification of the soils depend on human senses. It appears that soil color, depth and stoniness are the three basic attributes used by Jabal Al-Akhdar farmers are the primary characteristics of indigenous soil classifications with other relevant characteristics being predictive, and reflects a functional classification system (Furbee 1989). The inclusion of classes with a perceptual dimension, such as suitability, or sensitivity, increases this functional orientation. Soil scientists and the managers of land resources should recognize the existence of local knowledge pertaining to local soils, and should incorporate this into their professional assessments of soil and land suitability. This would facilitate communication between the two parties for the purpose of developing plans for sustainable land use.

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Glossary تعريف المصطلحات

Indigenous names	English literally meaning	Arabic Pronunciation	Arabic Meaning
Soil			
Attipa	Poor	عطيبه	فقيرة
Bel-Hoon	Marginal	بالهون	ضعيفة
E'Shahaba	Gray	اشهبه	فاتحة اللون
Gahweya	Brown, coffee color	جهويه - قهوية	لون القهوة
Garmasha	Sound like crisp	جارماشه - قارماشة	تعطي صوت مثل المقرمشات
Gaweya	Strong	جويه - قوية	قوية او غنية
Gazz	-	جز	قطع صخرية متوسطة الحجم
Ghamga	Dark	غامجه - غامقة	داكنة اللون
Ghariga	Deep	غاريجه - غاريقة	عميقة
Goara	-	جوره	خالية من الغطاء
Hait	Stone fragments	حيط	قطع صخرية كبيرة الحجم
Hajariya	Stony	حجريه	صخرية مفتتة
Hajif	-	حجف	صخرية مغطاة ببعض التربة
Hamra	Red	حمرا	حمراء اللون
Mekhalata	Mixed	مخلطه	متعددة المصدر
Mettaffla	Mixed with shale	مطفله	تحتوي علي الطفلة
Ragiga	Thin or shallow	رجيجه - رقيقة	رقيقة السمك
Sawda	Black	سودا	سوداء اللون
Semha	Good	سمحه	جيدة
Taga	-	طاجه	صخرية معراة
Torpa	Soil	تربه	تربة
Landscape		بطن	تل مرتفع ذو قمة مفرطحة
Baaten	Stomach	بطحة	سهل متسع و شبه مستوي
Battha	Plain	داردوحه	منحدر متجه لأسفل
Dardoha	Downward slope	ادبكه	مرتفع متسع و مستوي
E'Deppeka	Hornless ram	إظهره	السطح
E'Thhara	Back	حلج - حلق	تل مرتفع ذو قمة شبه
Halg	Throat	منجع - منقع	مستويه
Mangaa	Wet depression	رجبة - رقبه	منطقة ضيقة في قطاع الوادي
Raggba	Neck	راس	منطقة تجمع مياه الأمطار
Rass	Head	ساج - ساق	منطقة ميول بسيطة
Saag	Leg	سيل	بداية اي ظاهرة سطحية
Sail	Flood	صعوده	نهاية الميول البسيطة
Ssouda	Upward slope	ذيل	قاع المجري الرئيسي للوادي
Thail	Tail	وادي	منحدر متجه لاعلي
Wadi	Wadi		نهية اي ظاهرة سطحية
			الميول البسيطة لمجري
			الوادي و القابلة للزراعة

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المعارف المحلية وتقسيم الأراضي في منطقة الجبل الأخضر بالجماهيرية الليبية

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ازداد الاهتمام في السنوات الأخيرة بالمعارف المحليــة Indigenous Knowledge في المجال الزراعي بوجه عام و في مجال علوم الأراضي بوجه خاص. و قد تركــزت معظــم دراسات الأراضي علي استخدام المعارف المحلية في تقسيم و تصنيف التربة بواسـطة السـكان المحليين. وتتميز منطقة الجبل الأخضر في شمال شرق الجماهيرية الليبية بالتنوع فــي مواردهــا الأرضية و البيئية. و تلعب المعارف المحلية دورا هاما في التمييز بين أنواع الأراضي المختلفــة الموجودة في تلك المنطقة. و تهدف الدراسة الحالية الى تحديد الأسس و المعايير و الطرق التــي يستخدمها سكان الجبل الأخضر في تصنيف التربة و رصد وتسجيل المصطلحات اللغوية المحليــة المستخدمة في هذا التصنيف. تم اختيار منطقتين لأجراء الدراسة و هما منطقة شحات و التي تبعد ٢٠ كم شرق مدينة البيضاء و منطقة قصر المقدم و التي تبعد ٤٠ كم غرب مدينة البيضاء. و قــد اشــتملت الدراســة علــي إجــراء مقــابلات مــع الســكان المحليــين والتقيــيم الريفــي بالمشــاركةParticipatory Rural Appraisal (PRA) و المقطــع الطــولي التضاريســي المحليCommunity-based Landscape Transect و جمع عينات تربة ممثلة للأنــواع المختلفة من الترب المصنفة من قبل السكان المحليين وأجراء القياسات الحقلية و التقديرات المعملية لها؛ و قد تم رصد و تسجيل جميع المصطلحات و التعبيرات اللغوية والأسس التي يعتمــد عليهــا نظام التصنيف المحلي. و توصلت الدراسة إلى أن السكان المحليين يستخدمون عدد ١١ خاصــية Attributes للتعرف علي خصائص التربة، من بينهم ٣ خصائص تصنيفية و هي اللون و العمق و وجود وحجم القطع الصخرية. علي هذا الأساس فقد تم تقسيم ترب هذه المنطقة إلى ٤ أنواع في المستوي التصنيفي الأول بناءا علي الاختلاف في اللون (حمرا Red ، سوداBlack، اشهبه Gray ، جهوية Brown)، و إلى ١٠ أنواع في المستوي التصنيفي الثاني تبعا للون و العمق مثل: حمرا رجيجة Shallow Red ، حمرا غريجة Deep Red ، اشــهبه رجيجــه Shallow Gray، ووصل العدد إلى ٣٠ نوعا في المستوي التصنيفي الثالث بعد إضافة المحتــوي و حجــم القطــع الصخرية مثل: حمرا رجيجــة جــز Shallow Red with rock fragments 16-8 mm، حمــرا غريجــة جويــةDeep Red without rock fragments، اشــهبه رجيجــة جرماشــهShallow Gray with rock fragments less than 8 mm. و تعتبــر هــذه الدراسة الأولى من نوعها في تلك المنطقة و من الدراسات القليلة في المنطقة العربية و لذلك فــان هذا النوع من الدراسات يحتاج إلى المزيد من الإهتمام.