The impact of effective (geo-spatial) planning on the agricultural sector

by Anneliza Collett, Department of Agriculture, Forestry and Fisheries

Abstract

The protection of agricultural land for production purposes plays a major role in ensuring food security for South Africa. Only about 3% of the country’s surface is regarded as having high potential agricultural land. As South Africa is a developing country, great pressure is exerted on the remaining high potential agricultural land for developments and other non-agricultural land uses. It is important that this land be incorporated within all planning activities through a multi-disciplinary approach. This can only be done with the use of appropriate and accurate geo-spatial information. The use of geographical information systems (GIS) has enabled researchers to demarcate this land, but it has also identified the lack of incorporation thereof as an integral part of national planning.

Keywords

agriculture, planning, sustainability, agricultural potential, food security

Introduction

Access to food is a basic human need. Ensuring long term food security is a major challenge to many countries in the world. It is acknowledged that poverty is a fundamental cause of food insecurity. It is therefore critical for a country to retain its production capability to adhere to its food requirements. No country can afford to be too reliant on imports or it could become “hostage” to the demands of the supplying nation.

To produce food to meet the requirements of the general population, sufficient land with suitable and viable production capabilities needs to be available. Humankind’s survival is dependent on the availability of natural agricultural resources for production purposes and is central in ensuring that it is managed in such a manner that it is still available for future generations [2].

South Africa has only about 3 – 4% high potential agricultural land that is suitable for sustained food production. Much of this land has however been lost to other competing land uses. Agricultural production is under tremendous pressure from new or expanding residential or industrial developments and mining activities to facilitate current growth, but also from other factors such as access to water sources, climate change as well as volatile commodity and energy prices. In managing the pressures on land, it is important to conduct land use in such a manner that it optimally adheres to the potential of the land. It is imperative that all available land with a production potential be effectively utilised and protected for agricultural use but in such a manner that it does not result in the degradation or loss of available natural agricultural resources. This can only be achieved through the process of effective planning and with the aid of relevant geo-spatial information.

Planning has a major role to play in addressing threats to food security but it is not always a priority consideration during the planning processes. A coherent and multi-dimensional planning approach must be followed, ensuring that the most suited land use is identified for a particular area but more importantly that sustainable agricultural development and food security needs are met.

The principles of food security underpin the core focus areas of the National Development Plan, Vision 2030 (NDP). The NDP states that the national food security goal for South Africa is to maintain a positive trade balance for primary and processed agricultural products, whilst job creation and increased agricultural productivity is needed to address food insecurity at household and individual level in rural areas.

One of the key supporting mechanisms in achieving the above mentioned is geo-spatial information. Various spatial datasets exist that can aid in the planning process. These include data on agricultural potential, environmentally sensitive areas, current agricultural production areas as well as land use and land cover datasets, although derived at various scales that do not always make it suitable for planning at municipal level.

It is against this background that this paper will focus on the role of planning with the aid of existing geo-spatial information and the impact thereof on the agricultural sector, but with a specific focus on the integration of these two very important aspects.
The planning environment

Planners are trained to focus on communities, to conceptualise their environment and to collect, organise and disseminate information. They are able to analyse spatial dimensions of community needs, their concerns, available resources and ultimate goals and to put all of the mentioned into practices through effective spatial land use planning and supporting policies. They further have linkages to decision makers and to the decision making arenas within the public and private sectors where they can make recommendations on appropriate policies and plans that will deliver preferred outcomes [12].

Planners have the opportunity to play a vital role in adding their professional perspective on food security through a dynamic interaction in a multi-disciplinary approach with various subject matter specialists [3]. It is therefore within their power to bring, as part of a planning team, natural resource specialists (agriculturalists) on board that will guide the planning process in terms of the impact of a proposed development on agricultural potential and production and therefore assist in avoiding the loss of this land. Unfortunately this does not always happen and many spatial plans are developed without the input from a natural resource specialist or the use of available spatial information on the agricultural production potential.

Food security

There is no consensus on the correct definition of food security. The most widely used definition is the World Bank’s (1986) definition of food security as “access by all people at all times to enough food for an active, healthy life” [9]. It is expected that the world’s population of approximately 7-billion will increase to 9-billion by 2050, resulting in the need to annually produce an additional 1-billion tonnes of cereals and 200-million extra tonnes of livestock products by then. Currently, almost 1-billion people are undernourished, and even if agricultural production doubles by 2050, one person in twenty still risks being undernourished in developing countries. It is therefore of the utmost importance that “future agricultural production will have to rise faster than population growth”, most notably on existing agricultural land. The effective use and preservation of agricultural land is therefore crucial. It is estimated that, by 2030, an additional 120-million ha of land will be required to support the growth in food requirements. This estimation does not take into account the compensation required for losses resulting from unsustainable forms of agricultural production [8]. The Food and Agricultural Organisation (FAO) of the United Nations states that the availability of land and water to meet global and national demands for food and agriculture production have been put into sharp relief following the recent rise in commodity price levels (and associated volatility) as well as increased large-scale land acquisition. The social impacts of rapid food price inflation have hit the poorest hardest. The buffering capacity of global agricultural markets to absorb supply shocks and stabilise agricultural commodity prices is connected to the continued functioning of land and water systems. Climate change brings additional risks and further unpredictability of harvests for farmers – from warming and related aridity, shifts in rainfall patterns and the increase in frequency and duration of extreme events [8].

South Africa’s hunger index of 2005 showed that at national level, 51.6% of households experienced hunger, approximately 28.2% were at risk of hunger and only 20.2% appeared to be food secure. StatsSA reported in 2010 that about 23.9% of the South African population still experience inadequate access to food. Currently, 32% of South African children are hungry or are at risk of hunger. In addition, South Africa is currently a net importer of food, and therefore strictly speaking already food insecure.

Identified factors impacting negatively on continued and sustained food security include the loss of productive farmland due to the demand for competing land uses, uncoordinated and unplanned developments resulting in the fragmentation of agricultural land making it unviable agricultural units, leap frog developments especially at urban fringes, water scarcity, land degradation, access to land, security of tenure and population growth.

Sustainability

In 2002, Cielito F. Habito, the Secretary of Socio-economic Planning in the Philippines, said: “Sustainable development is not something governments or international bodies do to people. It is something people do to themselves and for their children” [6].

The principle of sustainability relies on three pillars namely economic, social and environmental. To a large extent focus fell on the first two elements, especially during planning processes, but the latter element did not receive the necessary attention despite concerted effort to increase the information base thereon.

Already in 1972, the United Nations (UN) Conference on the Human Environment [6], pointed out that economic growth, if not carefully monitored, would overshoot the earth’s ability to renew and maintain its resources to ensure future life and development. This concern was confirmed by the fact that in 2001 the global ecological footprint (people’s natural resource consumption) was 2.2 global ha per person, whilst the productive area of the biosphere was
estimated at an average of 1.8 global ha per person – translating into the fact that earth’s resources are being spent faster than they are generated. In the South African context, the ecological footprint is 2.8 global ha per person, higher than the world’s average, ranking South Africa 42nd out of 148 countries. Between 1991 and 2001, there was an increase of the per capita footprint by 2% and a decrease of the bio-capacity per capita by 4%. It can be concluded that there is an increase in pressures on the environment and that we have not yet been able to deal with these pressures effectively.

Natural resources form an integral component of the environment and should be seen on equal footing as social and economic requirements. The conflict between environmental management and economic growth is a matter of concern in sustainable development. There is increasing demand for the utilisation of natural resources by other uses that may have a detrimental effect on the environment. This can mainly be attributed to ineffective land use planning and the non-integration of environmental planning in the overall development plan. Environmental management should be an integral part of development planning [4].

The agricultural sector

Agriculture and its related activities is a cornerstone of any developing country. Not only is agriculture an economic asset, as it assists in the creation of jobs and alleviation of poverty but it is also crucial in feeding a nation.

State of agriculture in South Africa

In 2001, primary agriculture contributed 4.5% to the gross domestic product (GDP) and another 9% in terms of the larger agro-food complex. However, the percentage contribution of agriculture to the GDP declined to 3.2% (or R34-billion) in 2002 with a further decline to 2.6% in 2004. It is of concern if taken into consideration that in 1965 the contribution of agriculture to the GDP was 9.12% [5].
The management of agricultural land is administrated according to the provisions of the Sub-division of Agricultural Land Act, 70 of 1970. The Act not only manages the sub-division of agricultural land, but also evaluates proposed changes to land use for incorporation into existing towns, the registering of share block and sectional title schemes as well as servitudes and the leasing of agricultural land [14]. Within this Act “agricultural land” is defined as land that is located outside the demarcated municipal boundaries prior to 1994. State lands as well as the former homelands are excluded from the provisions of this Act as well as proclaimed protected areas. Therefore large portions of land, irrespective of its agricultural potential, is not regarding as agricultural land.

In order to understand the importance of the protection of agricultural land it is necessary to understand the limited natural agricultural resources available for production purposes in the country.

**Natural agricultural resources**

Natural agricultural resources means the natural resource base upon which the agricultural economy depends including the soil, water resources, agro-climate, and natural vegetation occurring on agricultural land but excluding invasive alien plants, weeds and bush encroachers.

South Africa’s natural resources are highly diverse, very sensitive and limited. Due to the locality of the country, a wide range of climatic conditions are found, as well as a large variation in soil and terrain characteristics. The variance in climate and topography in the country enables farmers to produce a large variety of crops but within suitable areas, under applicable conditions and with correct management and cultivation practices. This however places heavy demands on producers to determine the most suited crop type taking into consideration consumer demands and supply as well as market prices. Knowledge of the land resources, the short comings and possibilities forms the basis of any successful and sustainable farming practice.

**Fig. 3: Aridity zones in South Africa.**

- **Climate**

  The country’s annual rainfall varies from less than 200 mm in the western parts to more than 1000 mm in the eastern parts. Over half of the country receives an annual rainfall of less than 500 mm per annum, which is regarded as the minimum required for dry land crop production [1].

- **Soil**

  Only one national coverage on soil information is available for the country at a scale of 1:250 000 namely the national Landtype survey. Additional detailed soil surveys are continuously conducted but it is not always available due to a number of reasons. Unfortunately these detailed soil surveys are not captured within a national database due to inadequate regulations resulting in the fact that many surveys conducted over the years are not available that could have assisted in improvement of the soil information for the country.
The significance of the Landtype survey showed that more than one third of South Africa’s soils are regarded as shallow, with limited development possibilities [1]. Exposed rock covers 16 million ha or 13.2%, which is more than any single soil series and soil form, except Hutton. The average soil depth in South Africa is calculated at 577 mm. Only about 20% of the country has soils deeper than 900 mm [11].

A significant factor to acknowledge is that the country’s soil resources cannot be renewed in a human lifetime, if lost. This also includes the rehabilitation to damaged or degraded soils.

Fig. 4: Interaction of humans and the environment.

- **Water**

South Africa has limited water resources. Increasing demands are made on the water resources by the agricultural sector, industry and human consumption. It is predicted that South Africa will face a possible water deficit in 2025 [6].

Based on the limitations of the country’s natural agricultural resources farmers have no option but to farm on a scientific basis through the incorporation of available data and information within their farm and production plans. However this should not only be used by farmers but also by planners ensuring that the most suited land use option is selected and that non-renewable resources are not lost. One such data set that is to be used on a daily basis by planners is the demarcation of agricultural potential.

### Agricultural potential

The value of land depends on the scarcity or rarity of its quality in a specified area that often results in the land being irreplaceable and requires protection against uses that may be highly profitable [7]. Land evaluation and land capability determination play a pivotal role in land use management and the identification of land that should be protected for agricultural use.

Agricultural potential is described through the term land capability. Land capability means “the most intensive long-term use of land for purposes of rainfed farming, determined by the interaction of climate, soil and terrain and makes provision for eight land capability classes”. Land capability classes I – IV is regarded as arable land whilst classes V – VII are more suited for grazing purposes and class VIII for conservation. It is an expression of the effect of physical factors for crop suitability and potential that require regular tillage, for grazing, for forestry and for wildlife without damage to the resource.

High potential agricultural land means land best suited to, and capable of, consistently producing acceptable levels of goods and services for a wide range of agricultural enterprises in a sustainable manner, taking into consideration expenditure of energy and economic resources. It includes land capability classes I – III, irrigated land as well as unique agricultural land (land that is important to agriculture and used for the production of specific high value agricultural enterprises due to the special combination of location, terrain, climate and soil properties when treated and managed according to acceptable farming methods).

As previously indicated South Africa has a very limited amount of high potential agricultural land. Less than 14% of the country’s land is suitable for dry land cropping with only about 3% regarded as high potential agricultural land. This land is mainly found in four provinces, namely KwaZulu-Natal, Mpumalanga, Free State and Gauteng.
Large areas of this land are however no longer available for agricultural use. Almost all open cast mining activities in Mpumalanga as well as industrial related activities expanding into the rural areas of Gauteng occur on high potential agricultural land. Large portions of this land are also used for forestry purposes. For each hectare “taken from cropland by urban development, it usually means one more hectare is isolated and lost to farm production” [13].

A spatial national land capability dataset was developed in 2002 using the national Landtype survey data but incorporated additional factors such as erosion hazard, excess wetness, physical root zone limitations, subsoil acidity, terrain and climatic limitations.

The outcome of the work is currently used as the national norm for determining land capability. Results indicated that there are little or no soils in South Africa that are not subject to limitations. Most of the country’s soils have moderate to severe limitations largely due to limited soil depth or moderate erodibility, caused by sandy texture or slopes. Areas with a very good climate, such as in KwaZulu-Natal and the former Transkei, had to be degraded due to high slopes and limited soil depth. It was determined that nowhere in South Africa do best soil and good climate classes coincide.

Most of the arable land in the country is classified as either Class III or IV. Including Class IV, the total amount of arable land in the country is 23.4%. A large portion of Class III to VIII (98%) has severe limitations in terms of rainfall, terrain or soils. The unique farmland in the Western Cape especially, is classified as Class IV and V mainly due to limited soil depth. Table 1 indicates the distribution of the land capability classes per province, whilst Fig. 6 shows the distribution of the 2002 land capability classes in the country.

<table>
<thead>
<tr>
<th>Province</th>
<th>Percentage of province occupied by various classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Eastern Cape</td>
<td>0.1</td>
</tr>
<tr>
<td>Free State</td>
<td>0.0</td>
</tr>
<tr>
<td>Gauteng</td>
<td>0.0</td>
</tr>
<tr>
<td>KwaZulu-Natal</td>
<td>0.1</td>
</tr>
<tr>
<td>Limpopo</td>
<td>0.0</td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>0.0</td>
</tr>
<tr>
<td>Northwest</td>
<td>0.0</td>
</tr>
<tr>
<td>Northern Cape</td>
<td>0.0</td>
</tr>
<tr>
<td>Western Cape</td>
<td>0.0</td>
</tr>
<tr>
<td>RSA</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Table 1: Land capability classes for South Africa.

Due to the scale of the data and through an interactive modeling process (a combination of deductive-knowledge and inductive empirical methods) incorporating a large amount of additional variables for soil, climate and terrain as well as detailed soil survey information the 2002 land capability data set was refined for the Gauteng and Limpopo provinces to a scale of 1:50 000 for Gauteng and 1:80 000 for Limpopo. This has resulted in improved decision making and advancement in information on available agricultural land in the mentioned provinces.
Fig. 7 illustrates the improvement from the initial land capability product whilst Fig. 8 illustrates in red the loss of high value agricultural land due to unsustainable planning and fragmented developments especially adjacent to urban areas as well as the loss to mining (orange colour).

**Fig. 7:** A comparison of the land capability classification in an area after an intensive spatial modelling exercise and improvement of natural agricultural resources information.

**Fig. 8:** Loss of high value agricultural land due to development and mining activities.

In 2002 it was determined that approximately 28.7% of the 4% high potential agricultural land is located within Gauteng. In 2009 it was however determined that only 17.37% of the initial 28.7% is still available for possible production [10]. Many of this land is either located within urbanised areas or is fragmented making it too small to use as viable agricultural units.

**Available agricultural land for production**

The Department of Agriculture, Forestry and Fisheries (DAFF) has, as part of the development of a new policy on the “Preservation and Development of Agricultural Land” conducted a spatial analysis in 2012 of available agricultural land per the national land capability classification classes to determine the current status of agricultural land per province and the availability thereof through the exclusion of permanently transformed areas.

The analysis indicated that the surface area of arable agricultural land that had been converted to non-agricultural uses through urban and mining developments equals the size of the Kruger National Park.
The above analysis does not include areas that form part of protected areas as well as areas under plantations that are also not available for agricultural production. Especially in terms of mining in Mpumalanga concerning statistics were found as shown in Table 3.

<table>
<thead>
<tr>
<th>Land capability class</th>
<th>Total (ha)</th>
<th>Permanently converted</th>
<th>Remainder</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2 733</td>
<td>99</td>
<td>2 634</td>
</tr>
<tr>
<td>II</td>
<td>1 878 597</td>
<td>158 091</td>
<td>1 720 506</td>
</tr>
<tr>
<td>III</td>
<td>14 003 339</td>
<td>1 031 922</td>
<td>12 971 417</td>
</tr>
<tr>
<td>IV</td>
<td>16 447 446</td>
<td>788 505</td>
<td>15 658 941</td>
</tr>
<tr>
<td>V</td>
<td>13 609 335</td>
<td>254 809</td>
<td>13 354 526</td>
</tr>
<tr>
<td>VI</td>
<td>18 114 793</td>
<td>538 692</td>
<td>17 576 101</td>
</tr>
<tr>
<td>VII</td>
<td>45 343 216</td>
<td>281 774</td>
<td>45 061 442</td>
</tr>
<tr>
<td>VIII</td>
<td>12 279 370</td>
<td>85 398</td>
<td>12 193 972</td>
</tr>
<tr>
<td>Water</td>
<td>246 052</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>121 924 881</td>
<td>3 385 343</td>
<td>118 539 538</td>
</tr>
</tbody>
</table>

Table 2: Agricultural land, per land capability class, permanently converted to non-agricultural land use purposes.

Table 3: Loss of high value agricultural land due to mining activities in Mpumalanga.

The relationship of population vs. available high potential arable land for three specific years (1996, 2001 and 2005) was also determined and clearly indicates the declining trend of arable land available for food production over the period, to an area of 0,31 ha per person per annum in 2005. It is estimated that the current area available per person is less than 0,25 ha. This is of major concern as the international norm for food security is 0,4 ha per person per annum.

<table>
<thead>
<tr>
<th>Year</th>
<th>Transformed</th>
<th>Available</th>
<th>Population</th>
<th>ha/capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>537 974</td>
<td>15 346 695</td>
<td>40 584 000</td>
<td>0,38</td>
</tr>
<tr>
<td>2000</td>
<td>806 146</td>
<td>15 078 523</td>
<td>44 820 000</td>
<td>0,34</td>
</tr>
<tr>
<td>2005</td>
<td>1 190 112</td>
<td>14 694 557</td>
<td>46 888 000</td>
<td>0,31</td>
</tr>
</tbody>
</table>

Table 4: Arable land (land capability classes I – III) depicted as ha/capita for three years; 1996, 2000 & 2005.
Conclusion

South Africa has a limited supply of high potential cropping land. This non-renewable resource can only be effectively protected through appropriate and relevant planning processes. Every land parcel that has an agricultural production potential should be used optimally but sustainably for food production. The FAO regards land use planning as the “systematic assessment of land and water potential, alternatives for land use and economic and social conditions in order to select and adopt the best land use options”. Land use options should meet the needs of people without compromising the resource [7].

Fig. 10: Illustration of effective land use planning for sustainable development.

Any change of land from agriculture to other forms of (unrelated) developments should be limited. Conflicting land uses impacts negatively on agricultural production and the protection of the “right to farm” should be taken into consideration during the planning process. This includes limiting the fragmentation of agricultural land through subdivision resulting in unviable, non-economical and unsustainable farming units. The key factors to the preservation and development of especially high potential agricultural land should be:

- Protection
- Avoidance
- Minimisation
- Mitigation
- Productivity

The lack of a comprehensive and integrated national geo-referenced information system demarcating different categories (zones) of agricultural land, land capability, land suitability, current land use and land administration functionalities suitable for use from farm to national level requires urgent attention. Detail level geo-spatial information will guide in the decision making processes and will ensure more informed decisions based on suitable information. Accurate and detailed information also allows for improved statistical analysis in determining the status of the agricultural sector and its impact in South Africa. Improved decision-making and policy development can benefit from the advantages of information and knowledge management and will result in an effective, sustainable and economically prosperous agricultural sector.

References


Contact Anneliza Collett, Department of Agriculture, Forestry and Fisheries, Tel 012 319-7508, annelizac@daff.gov.za