DEVELOPING SOFTWARE TO BUILD SUSTAINABLE FOREST MANAGEMENT PLAN IN BINH PHUOC PROVINCE

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SUMMARY

Sustainable forest management software was developed by using Microsoft Visual C # professional 2010 with the help of Microsoft Access 2010 and Mapinfo Pro17.0 in 2020 in Binh Phuoc province with the overall goal to build a sustainable forest management plan for each forest owner from the map of sustainable forest management. The software has specific goals: (1) To update a forest protection and management map for the forest owner; (2) To synthesize thematic data on land management systems, planning of three forest types, forest origin, tree species, forest status, non-timber forest products… (3) To build a datasheet system as the requirement of a sustainable forest management plan. In which has land use plan, forest development plan, forest protection plan, forest product exploitation plan… (4) To determine options for forest management and use. (5) To export the output results in Excel and Word format. The software has been applied to build sustainable forest management plan for the period 2021 - 2030 for Ta Thiet Protection Forest Management Board and Loc Ninh Protection Forest Management Board in Loc Ninh district, Binh Phuoc province, with accurate results, high speed of treatment, large capacity, and stable. This software is installed and run independently on personal computers. In future, the software will contribute to support research and building sustainable forest management plan of forest owners.

Keywords: Binh Phuoc, developing, forest management, plan, software, sustainable.

1. INTRODUCTION

Forest resource is considered as one of the basic factors determines the existence and development of human society. Sustainable management, protection and development of forest resource to ensure sustainable development of economic, social as well as environmental is an inevitable trend of countries in the world. Determining the importance of forest resource, Vietnam's forestry sector has made strong changes in the socio-economic development periods, especially in the integration period. One of the drastic moves is to change the method of forest resource management from "Forest modulation" to "Sustainable forest management". The content of sustainable forest management has been concretized in: Forestry Law No. 16/2017/QH14 issued on November 15, 2017 by the National Assembly. Decree No. 156/2018/NĐ-CP issued on November 16, 2018 by the Government detailing the implementation of a series of articles of the Forestry Law. (3) Circular No. 28/2018/TT-BNNPTNT issued on November 16, 2018 by the Ministry of Agriculture and Rural Development to regulate sustainable forest management. Binh Phuoc is a province that located in the Southeastern region with favorable natural conditions for socio-economic development. Especially the development of agricultural and forestry production, such as: husbandry, plantation, industrial trees, fruit trees... But this advantage also creates the pressure on the management, protection and development of forest resources, especially the conversion of forest land to other purposes. In general, the area of forest land has always been narrowed down according to the planning periods, the natural forest area gradually decreased replaced by plantation and other land uses areas. By the end of 2019, the total area of forest and forestry land is 174,381.02 ha and reaches 22.75% coverage. The entire forest land area has been allocated to more than 80 organizations and individuals for management and use [1]. Facing the current situation and the role of forest land resources; People's Committee of Binh Phuoc Province has directed forest owners to build plan of sustainable forest management for the period

of 2021 - 2030. But at present, the development of sustainable forest management plans for forest owners is still difficult because there are no databases and specialized software. This research will contribute to support forest owners to overcome the above limitations by developing a software to build sustainable forest management plan with specific goals: (1) To build a forest protection and management map for the forest owner; (2) To summary of current state of forest land use; (3) To build a datasheet system as required of a sustainable forest management plan; (4) To determine options for forest management and use; and (5) To export the output results in Excel and Word format.

2. RESEARCH METHODOLOGY

2.1. Methodology

- The sustainable forest management plan is designed for each forest plots over a 10 -year cycle. The development of a sustainable forest management plan for a forest owner is considered generally in many aspects at present as well as in the future. The contents to be considered are natural, economic, social conditions, policies, forest protection, forest development, non-timber forest products, forest product exploitation, planning of three forest types, landscape ecology, investment, economic efficiency… Thus, each forest plots is attached a lot of attribute information. Such information must be structured according to general standards of forestry sector. Therefore, it is necessary to develop a sustainable forest management map typically for each forest plots in accordance with current technical regulations of the forestry sector to serve as a database set for the development of sustainable forest management plan.

- Requirements of a sustainable forest management plan with many contents, both present and future, and must ensure accuracy, consistency, large data capacity, conversion through many different data types. So, professionally, this is often a quite complicated task for each forest owner. But, in computer science, it is possible to use programming languages to set up program segments to solve these contents quickly, accurately and promptly. Because in computer programs, the programming language also allows the use of algorithms for statistics, analysis, modeling, synthesis and output of data sheets in Excel and Word format. So, using the Microsoft Visual C # professional 2010 programming language to develop software to automate the development of a sustainable forest management plan is essential and feasible.

- In order to make the development of a sustainable forest management plan to be easy, convenient and popular for each forest owner, the software should also be designed to be intuitive, friendly, highly automated and packaged for direct installation into other personal computers.

2.2. Implementation steps

- Regarding database development: On the basis of maps of forest changes, forest inventory, site, hydrology and traffic at year 2020 of Binh Phuoc province from the Department of Agriculture and Rural Development; economic and social data from Statistical Office and the results of field survey in forest owners has built The Sustainable Forest Management Map in MapInfo. This map has information and structure of properties table according to current technical requirement of forestry industry. Next to this map is a system of tables designed in the Access environment according to the provisions of Circular 28.

- Building software development process: Software is developed in a spiral sequence, including the following contents:

(1) Constructing ideas: According to the guidance in Circular 28, the contents need to be automated. Each of this content is a function of the software. The software should be able to read the attribute data of the sustainable forest management map and the designed datasheet system. Carry out programming and building functional modules

to query input data, automate analysis, process, synthesize and export the output results as data tables in accordance with the Circular No. 28 in the form of Excel and Word.

(2) Discuss with the experts at forestry sector about the idea of the software, complete the idea and outline the idea into a functional figure of the application.

(3) Design of functional modules: Modules are designed to be simple and easy to use. Programming and processing data in modules must be highly automated to meet the requirements of simple form design. The algorithms used in modules are: object selection, conditional query, synthesis, analysis, construction and output of result tables.

(4) Connecting functional modules: Functional modules are connected together according to the master diagram to form the Software.

(5) Test run, evaluate, package and install: (1) Run test software, detect and re-tune the software until the goals are set. (2) Create *.exe* file for the software and install it independently on other personal computers.

Development tools to develop this Software are Microsoft Visual C # professional 2010 and other supporting software, such as MapInfo professional, Google Earth Pro, and Access.

3. RESULTS AND DISCUSSION

3.1. Constructing the concept and basic functions of the software

The idea to develop software for building a sustainable forest management diagram is illustrated in the Figure 1.

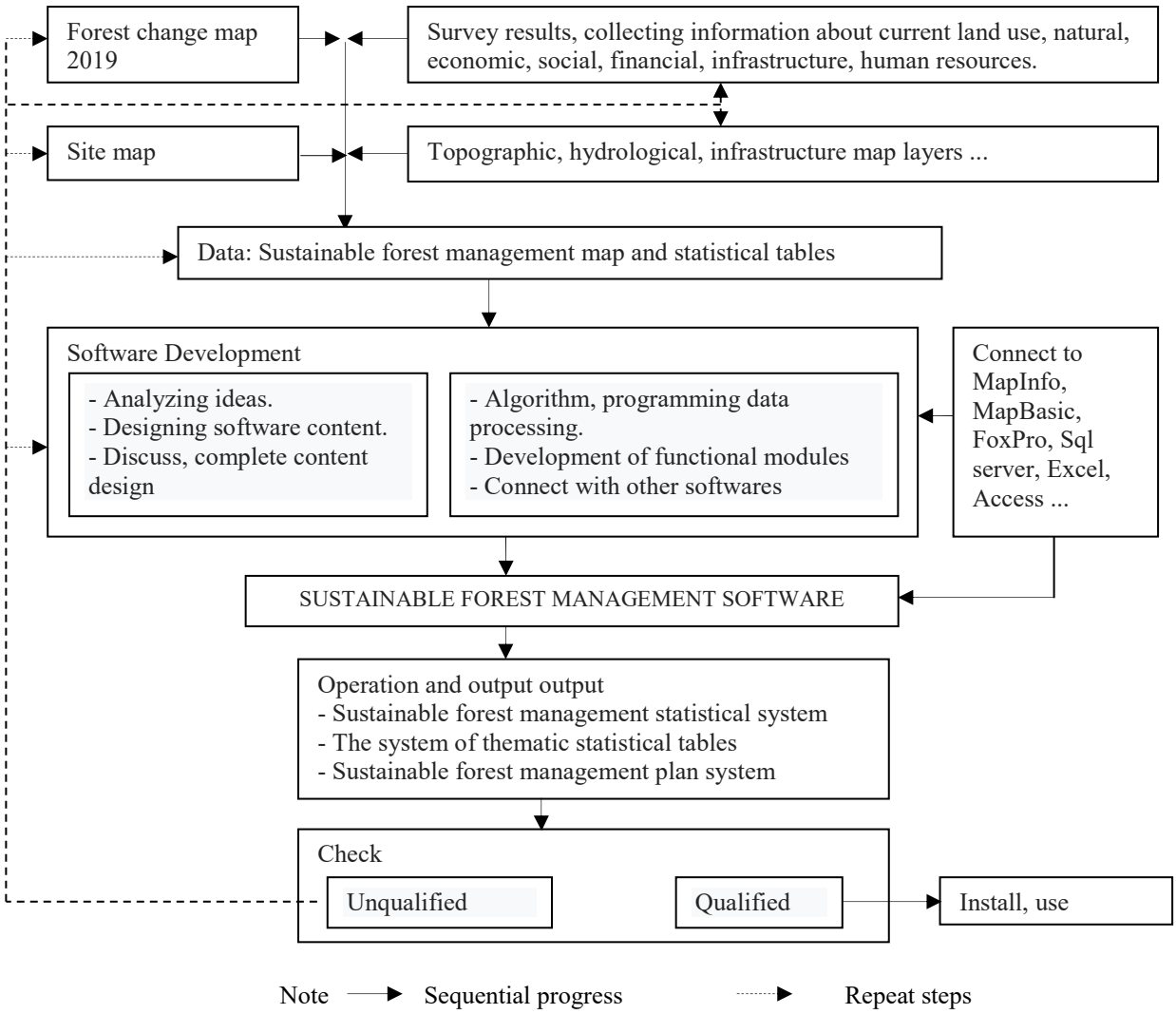


Figure 1. Diagram of conceptual development of Sustainable Forest Management Software

From the result of conceptual analysis, a functional overview of the Sustainable Forest Management Software was built as shown in Figure 2. Accordingly, the software has 30 functional modules, classified into 3 groups, including: Group Content-based statistics have 10 functional modules. The group of summary tables has 13 functional modules. The sustainable forest management plan group has 7 functional modules. Each functional module will carry out a necessary content of a sustainable forest management option.

Thematic statistics	Summary tables	Sustainable forest management
Land management System	People, economy - society	Separated from the stand
Planning three types of forests	Current technical infrastructure	Planning three types of forests
Site, forest origin	Current land use by commune	Forest protection
Land use type	Statistics of forest status	Forest development
Tree species	Statistics of forest reserves	Biodiversity
Reserve, status	Major forest plant species	Non-timber forest products
Projects	Endangered and rare forest plants	Connect with Google Earth
Into the forest	Main forest animals	
Year of planting	Endangered and precious forest animals	
Non timber forest products	General land use plan	
	Synthesize forest product exploitation plan.	
	General construction plan for infrastructure	
	Business results of forest owners	

Figure 2. Functional groups of Software for sustainable forest management

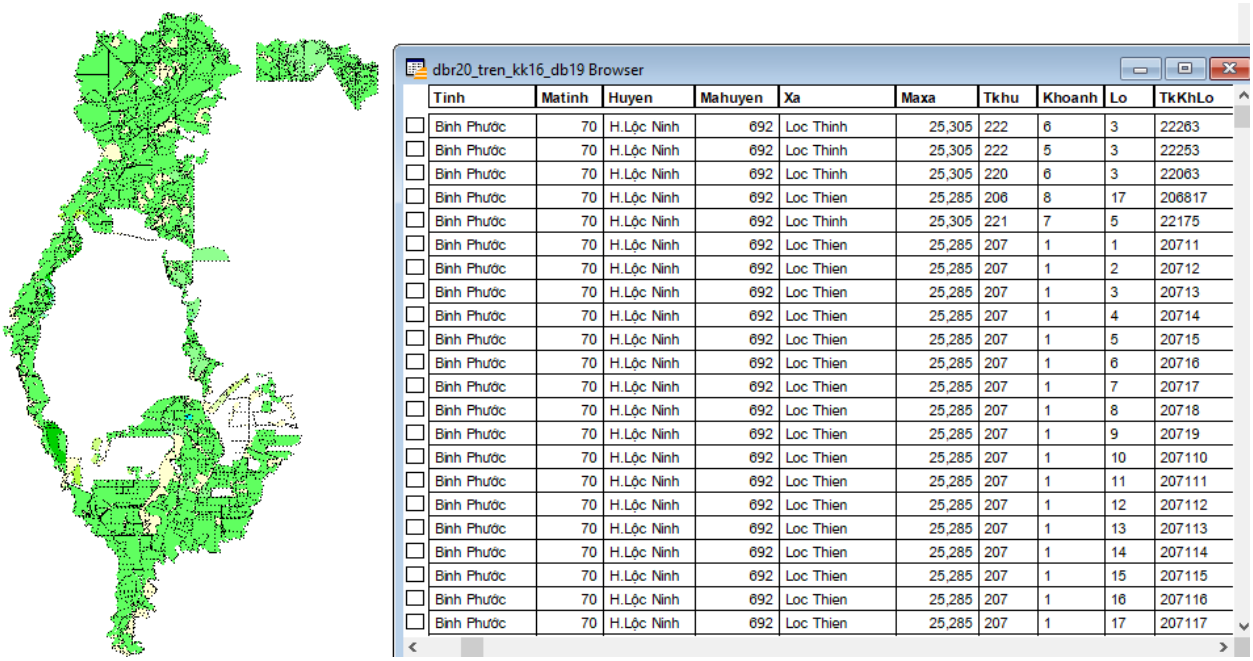
3.2 Database and software functions

a) Database: The database of this software includes a map of sustainable forest management and statistical tables illustrated as Figure 3 and Figure 4 show that: (1) Map has built in MapInfo environment, isolated to forest plots, each forest plots is affixed with attribute information on sustainable forest management in accordance with data technical regulations of forestry sector. This map is the main database to develop a sustainable forest management plan for each forest owner. (2) Statistical tables are built in Access environment, containing the information needed to develop a sustainable forest management plan.

dmdvcy

MAPINFO_ID	STT	TenHoVn	TenHoKhoc	TenLoaiVn	TenLoaiKhoc
1	1	Sóc	Sciuridae	Sóc bụng đỏ	Callosciurus erythraeus
2	2	Rắn nước	Colubridae	Rắn ráo	Ptyas korros
3	3	Cu cu	Cuculidae	Bìm bịp lớn	Centropus sinensis
4	4	Lợn	Suidae	Lợn rừng	Sus scrofa
5	5	Bồ câu	Columbidae	Cu gáy	Streptopelia chinensis
6	6	Sẻ	Passeridae	Chim sẻ	Passer domesticus
7	7	Chuột	Muridae	Chuột	Rattus andamanensis
8	8	Họ khỉ (Linh trưởng)	Cercopithecidae	Khỉ vàng	Macaca mulatta
9	9	Mèo	Felidae	Mèo rừng	Felis bengalensis
10	10	Trĩ	Phasianidae	Gà rừng	Gallus gallus
11	11	Chào mào	Pycnonotidae	Chào mào	Pycnonotus jocosus
12	12	Đớp ruồi	Muscicapidae	Chích chòe	Copsychus saularis
13	13	Chim sâu	Dicaeidae	Chim sâu	Dicaeum concolor
14	14	Tắc kè	Gekkonidae	Tắc kè	Gekko gekko

Figure 3. Datasheet to develop a sustainable forest management plan



dbr20_tren_kk16_db19 Browser

Tinh	Matinh	Huyen	Mahuyen	Xa	Maxa	Tkhu	Khoanh	Lo	TkKhLo
Binh Phước	70	H.Lộc Ninh	692	Loc Thinh	25,305	222	6	3	22263
Binh Phước	70	H.Lộc Ninh	692	Loc Thinh	25,305	222	5	3	22253
Binh Phước	70	H.Lộc Ninh	692	Loc Thinh	25,305	220	6	3	22063
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	206	8	17	206817
Binh Phước	70	H.Lộc Ninh	692	Loc Thinh	25,305	221	7	5	22175
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	1	20711
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	2	20712
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	3	20713
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	4	20714
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	5	20715
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	6	20716
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	7	20717
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	8	20718
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	9	20719
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	10	207110
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	11	207111
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	12	207112
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	13	207113
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	14	207114
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	15	207115
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	16	207116
Binh Phước	70	H.Lộc Ninh	692	Loc Thien	25,285	207	1	17	207117

Figure 4. Structure of sustainable forest management map (Ta Thiet Protection Forest Management Board)

b) Operation process of software: After being installed on computers, Sustainable forest management software has an operational procedure consisting of steps in the following order: (1) Step to activate the software: Select the shortcut icon of the software on the computer screen or in the start menu of windows. (2) Step to select processing content: Select the drop menu in the main menu according to the content to be processed. (3) Step to process data: Select the forest owner from the check box and select the processing button so software will process and export the processing result on the screen. (4) Step to export result: After get the processing result on the screen, select the export button so software will export the result on the screen into an Excel worksheet.

c) Software function: The sustainable forest management software has 3 main functional groups, including the following basic functions:

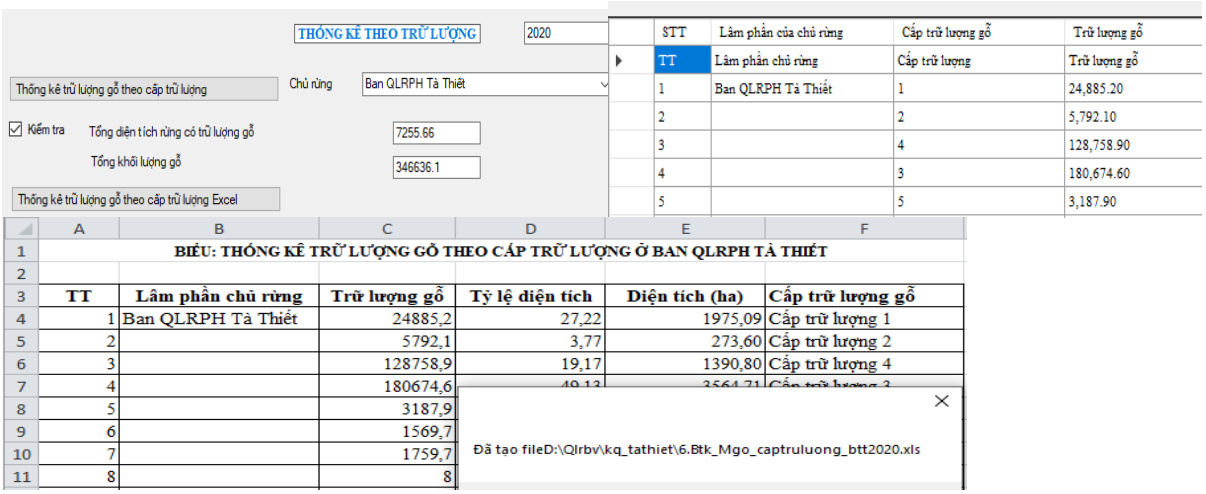


Figure 5. Construction of thematic statistical tables

- *Thematic statistics:* The software will query information from the sustainable forest management map to analyze, process, synthesize and export the results base on the topics such as current forest status, planning, origin, type of tree, year of planting, forest volume, and non-timber forest products. The results are shown in the Excel table as in Figure 5.

- *Establish statistical tables:* Establish statistical tables in accordance with Circular 28 on natural, economic, social conditions, forest status, land use plan, forest product reserves, forest protection and development plan... were illustrated in Figure 6.

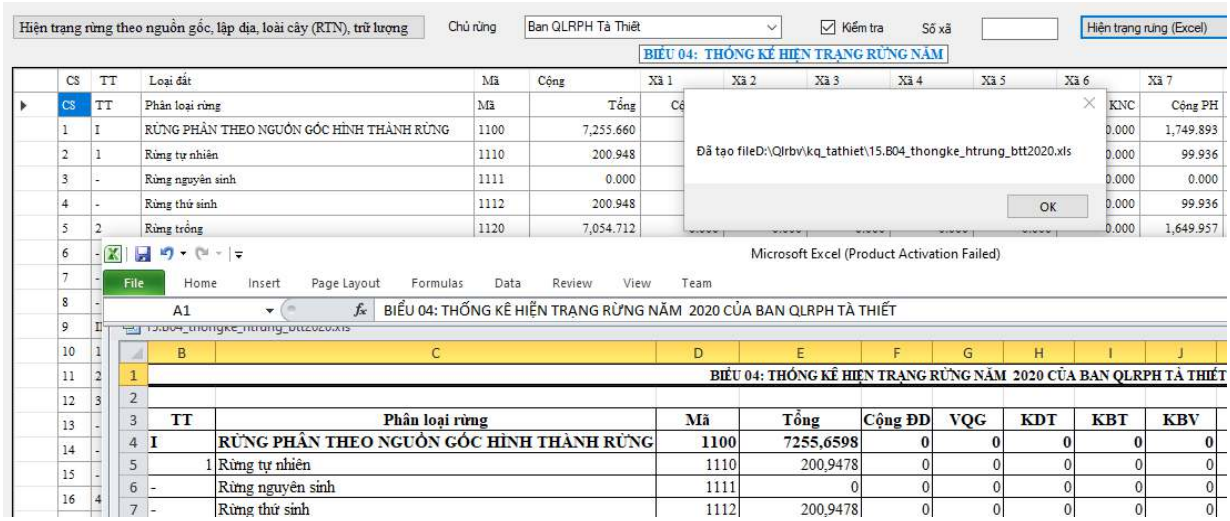


Figure 6. Development of statistical tables according to Circular 28

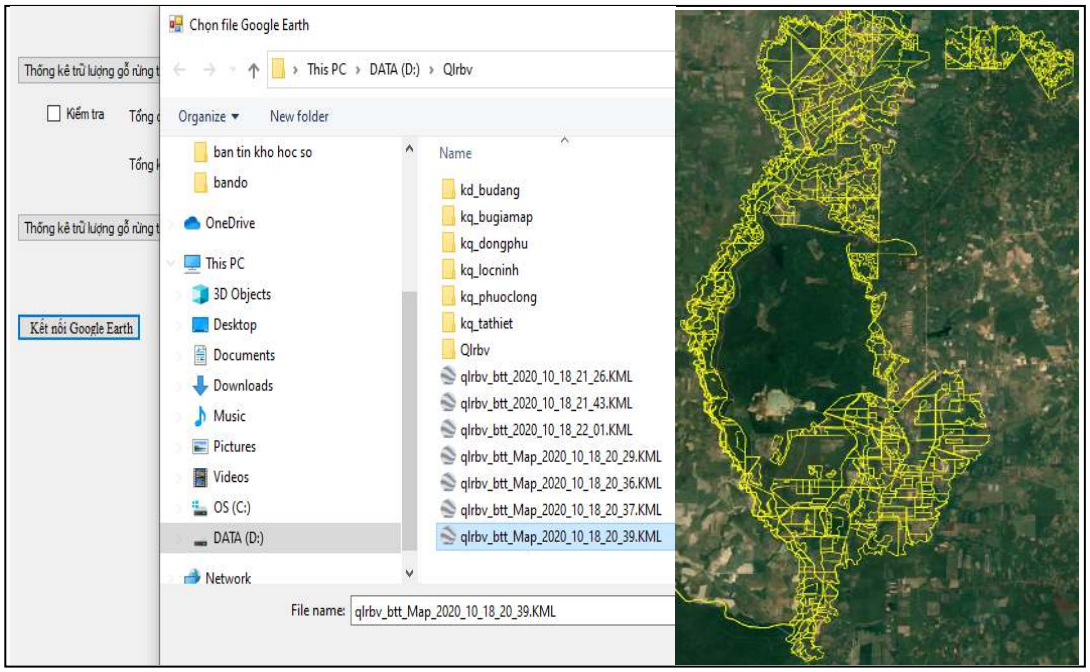


Figure 7. Connecting to Google Earth for area monitoring, forest resource management

- *Develop sustainable forest management plan:* Develop options for planning three types of forests, forest management, forest development, biodiversity, forest products and non-timber forest products, connect with Google Earth is shown in Figure 7.

4. CONCLUSION

A sustainable forest management map of forest owner has been developed in accordance with the current technical regulations of the forestry sector.

Has been developed sustainable forest

management software in Microsoft Visual C # professional 2010 language with basic functions to automate the development of sustainable forest management plans of a forest owner.

The software has been applied to develop a sustainable forest management plan for the period 2021 - 2030 of Ta Thiet protection forest management board and Loc Ninh protection forest management board, Loc Ninh district, Binh Phuoc province, thereby confirming that stability, accuracy.

The software is written with open source code, with a spiral development process. Therefore, in the coming time, the author will continue to improve and add functions to suit the practical conditions in Binh Phuoc.

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PHÁT TRIỂN PHẦN MỀM XÂY DỰNG PHƯƠNG ÁN QUẢN LÝ RỪNG BỀN VỮNG Ở BÌNH PHƯỚC

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TÓM TẮT

Phần mềm quản lý rừng bền vững được phát triển bằng Microsoft Visual C# professional 2010 cùng với sự trợ giúp của Microsoft Access 2010 và Mapinfo Pro 17.0 vào năm 2020 tại Bình Phước nhằm mục tiêu tổng quát là xây dựng được phương án quản lý rừng bền vững cho mỗi chủ rừng từ cơ sở dữ liệu chính là bản đồ quản lý rừng bền vững. Phần mềm có những mục tiêu cụ thể: (1) Cập nhật được bản đồ quản lý bảo vệ rừng cho một đơn vị chủ rừng. (2) Tổng hợp được số liệu chuyên đề về hệ thống quản lý đất đai, quy hoạch ba loại rừng, nguồn gốc rừng, loài cây, trạng thái, lâm sản ngoài gỗ... (3) Xây dựng được hệ thống biểu số liệu theo yêu cầu của một phương án quản lý rừng bền vững, trong đó có kế hoạch sử dụng đất, kế hoạch phát triển rừng, kế hoạch bảo vệ rừng, kế hoạch khai thác lâm sản. (4) Xác định được các phương án quản lý, sử dụng rừng. (5) Xuất kết quả đầu ra ở dạng Excel, Word. Phần mềm đã được ứng dụng để xây dựng phương án quản lý rừng bền vững giai đoạn 2021 - 2030 của Ban QLRPH Tà Thiết và của Ban QLRPH Lộc Ninh, thuộc huyện Lộc Ninh, tỉnh Bình Phước cho kết quả chính xác, tốc độ xử lý nhanh, dung lượng xử lý lớn, ổn định. Đây là phần mềm được cài đặt và chạy độc lập trên các máy tính cá nhân. Phần mềm sẽ góp phần hỗ trợ cho công tác nghiên cứu cũng như lập phương án quản lý rừng bền vững của các chủ rừng.

Từ khóa: bền vững, Bình Phước, phát triển, phần mềm, phương án, quản lý rừng.

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