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DEVELOPMENT OF A POPULAR SCIENTIFIC BOOK ON THE STAND POPULATION STRUCTURE ALONG THE BANKS OF ALUH-ALUH RIVER

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Abstract. This study aims to describe the validity and practicality of the Popular Scientific Book on the stand population structure along the banks of the Aluh-Aluh River, Simpang Warga Village, Banjar Regency. The development process used the Plomp and Nieveen model consistd of 3 stages: 1) preliminary research; 2) prototyping stage; and 3) assessment phase. The validation and readability tests were conducted using validation and readability questionnaire instruments, while the practicality test used a practicality questionnaire instrument. The validity of the Popular Scientific Book developed obtained a score from three validators of 92.05%, categorized as very valid, indicating that the BIP is structurally and procedurally suitable for use in learning Plant Ecology courses as enrichment material. The readability of the Popular Scientific Book from three students obtained a score of 94.4% with very good criteria. The practicality of the Popular Scientific Book developed obtained a score of 97% with the criteria of very practical from 6 students, meaning that the Popular Scientific Book developed, according to students, is easy to use or very practical to use in learning the Plant Ecology course as enrichment material.

Keywords : popular science books, population structure, practicality, validity

INTRODUCTION

A population is a group of individual organisms that share similar characteristics, originate from the same source, and interact and reproduce freely without significant barriers (Wirakusumah, 2010). Population characteristics include density, birth rate (natality), death rate (mortality), age distribution, biotic potential, and patterns of growth and development. Population distribution can be influenced by human activities. Humans contribute to the distribution of plant populations but can also be a factor in the rarity of certain species. The population status of plants in their natural habitats can be categorized into three conditions: critical, threatened, and safe (Corlett, 2016).

According to Odum (1993), population structure includes such as density and distribution patterns, plant demography, stage and age, fecundity, age structure, and stage structure. Almost all populations exhibit three ecological age groups, namely 1) *pre-reproductive* when plants have not flowered or borne fruit, 2) *reproductive* when plants have flowered or borne fruit, and 3) *post-reproductive* when plants do not flower or bear fruit, are damaged, and die. Based on age structure, population structure has three basic patterns, namely: 1) Pyramid with a wide base, with a greater number of young individuals than old ones, 2) Pyramid of a bell-shaped polygon, with the development of the number of young age groups balanced with the old age group, and

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3) Pyramid in the form of a vase or jug, which has a smaller number of young individuals than the group of old individuals (Maretasari et al., 2019).

Population structure is influenced by three main factors: environmental conditions, reproductive methods, and human activities. The status of a population is determined by its reproductive performance over time. Typically, a rapidly growing population contains a majority of young individuals. Studying population structure is crucial to determine the status and condition of a population in its natural habitat. Population status is often categorized into three levels: critical, threatened, and safe. Once the status of a plant population in a given area is identified, appropriate steps can be taken to prevent the extinction or scarcity of the population (Dahlberg & Mueller, 2011; Halder & Jha, 2023)

Several studies that have been conducted in different places and times have examined the population structure of certain plants. For example, research by Anggraini et al., (2024), regarding the population structure of sungkai (*Peronema Canescens* Jack.) In the Sari Dew Lake area, Tanah Laut Regency. Furthermore, research by Aj (2023), regarding the population structure of pulai (*Alstonia Scholaris*) in the Sari Dew Lake area, Tanah Laut Regency. Research by Raihani (2023), regarding the population structure of pine plants (*Pinus Merkusii* Jugh et de Vriese) in the Sari Dew Lake area, Tanah Laut Regency. From these three studies, it can be seen that the plants studied have different population structures. This is the basis for conducting research on the Population Structure of Plants on the banks of the Aluh-aluh River, Aluh-aluh District, Banjar Regency, South Kalimantan. Aluh-aluh District, Banjar Regency, South Kalimantan. Simpang Warga Luar Village has an area of 4.00 km^2 400 ha with a lowland area and is located in a coastal area. Aluh-Aluh River that passes through Simpang Warga Village along its banks is found various plants that grow naturally or are planted by the community and used. These various plants have not been recorded and have not been published and are widely distributed so that it is necessary to introduce to the general public the existence and natural wealth in this area, especially in the study of its population structure (Ansari et al., 2015).

The information obtained can also support the world of education, namely as teaching materials that are useful for increasing insight and knowledge. The teaching materials in question are BIP or known as Popular Scientific Books. This is in accordance with Latifah et al., (2020) that Popular scientific books that are developed must be based on field research with data obtained through direct observation and measurement at the research location. According to Anggraeni's research (2023), this teaching material states that the results of BIP have a validity score of 3.67 with very valid criteria and a student readability score of 93.05% with very good criteria. This BIP has the advantage of being a public knowledge material that is equipped with relevant literature, and original images obtained from the field, written simply, using popular language, and concisely. This research is useful for the national community, especially teachers, because this research can be used as a reference or literature in creating media learning. Aj's research (2023) stated that BIP is indicated by its validity score of validator 1 and validator 2 with an average validity score of 3.63 with very valid or feasible development criteria and student readability tests of 91.67% with very good criteria so that the Scientific Book of Population Structure of Pulai (*Alstonia Scholaris*) in the Danau Seri Embun Area, Tanah Laut Regency is suitable as teaching material. The latest research, namely Raihani (2023) which stated that the Study of the Population Structure of Pine Plants (Pinus merkusii Jugh et de Vriese) in the Danau Sari Embun Area was stated by two validators as very valid with a score of

3.48 validity and for the readability test, it got a score of 83.33% with a very good category.

Popular Scientific Books (BIP) play a crucial role in facilitating public understanding—especially among students—of complex scientific topics. This is supported by Utami et al. (2021), who stated that BIP serves an important function in bridging the gap between the scientific community and the general public, thereby enhancing public comprehension of research findings. In the context of population structure along the banks of the Aluh-Aluh River, Simpang Warga Village, Banjar Regency, the development of BIP is essential to help translate technical ecological knowledge into content that is accessible to a broader audience. Learning about the riparian ecosystem in this area is particularly relevant for supporting environmental sustainability. As an advanced course that explores the relationship between plants and their environment, the Plant Ecology course requires references that effectively connect theoretical concepts with practical field applications. These references must be easily understood by both students and the local community.

Preliminary studies conducted through literature reviews and field observations have shown that the Aluh-Aluh River possesses high biodiversity potential. This makes the area a valuable source of information and study material for both the local community and students, particularly in understanding the importance of stand population structure in maintaining ecosystem balance. Field observations revealed that riparian vegetation along the riverbanks plays a vital role in maintaining soil stability, regulating water quality, and supporting habitats for local fauna. Therefore, understanding the dynamics of plant populations in this area is essential—not only for higher education learning needs but also for communities that directly depend on the ecosystem. The development of a Popular Scientific Book (BIP) on the structure of plant populations along the Aluh-Aluh River would make a significant contribution by addressing the current lack of accessible information. Research conducted at higher education institutions has found that students often struggle to understand the application of plant ecology concepts in specific local contexts, such as in Banjar Regency. A BIP would present data and information in a systematic yet easy-to-understand format, enriching the learning experience of both students and the general public involved in conservation and natural resource management.

The urgency of publishing a BIP is also supported by the public's need for knowledge that can be directly applied to environmental conservation efforts. Field studies involving the local community indicate that their knowledge of riparian ecosystems is limited to only basic aspects. This book is expected to present scientific content in a more engaging and accessible way while providing deeper insights into the role of population structure in preserving ecosystems and ensuring river sustainability. Thus, this BIP will not only serve as a learning tool but also as a means of empowering the public to take an active role in conserving their surrounding environment. The use of Popular Scientific Books can deepen, expand, and disseminate knowledge in the form of enrichment materials. Based on the above, research on plant population structure and the development of a Popular Scientific Book is considered necessary and highly relevant.

RESEARCH METHODS

The research approach employed is descriptive quantitative and developmental, using the Plomp and Nieveen model, which consists of three stages: preliminary research, prototyping stage, and assessment phase. This study was conducted during Stage 1 on the banks of the Aluh-Aluh River in Simpang Warga Village, Banjar Regency, to collect data on the Population Structure of Standing Trees. Stage 2 involved

the preparation, development, and validation testing of the product. Stage 3 focused on conducting readability and practicality tests. The readability and practicality tests were carried out in the Biology Education Study Program, Faculty of Teacher Training and Education, Lambung Mangkurat University (ULM) Banjarmasin. These tests were conducted in stages: first, the readability test, followed by the practicality test. The readability test involved 3 participants, while the practicality test was conducted with 6 students who had previously completed the Plant Ecology course with an A grade, serving as the trial subjects. The trials were conducted on a limited scale, in line with Nurasih et al. (2020), who stated that the practicality of scientific books can be measured through limited trials involving target readers to gather constructive feedback. The object of this research is a Popular Scientific Book (BIP) developed based on field research findings on the Population Structure of Standing Trees along the Aluh-Aluh River in Simpang Warga Village, Banjar Regency. The data presented in this article consist of the results and analysis from the readability and practicality tests of the BIP, which is based on prior research data concerning the population structure of stands in the Aluh-Aluh riverbank area. The research and development scheme implemented in this study follows the Plomp and Nieveen model, as illustrated in Figure 1.

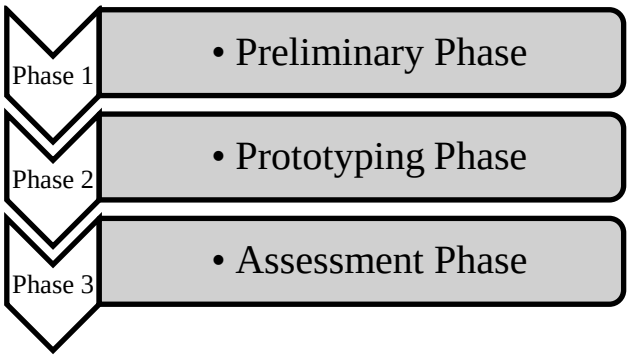

Figure 1. Research and development phase of the Plomp and Nieveen model

RESEARCH RESULTS AND DISCUSSION

The first stage, preliminary research, was carried out by analyzing the population structure of the observed stands, which included the pre-reproductive, reproductive, and post-reproductive phases. The research sample consisted of the entire population of stands found within a 50-meter width from the riverbank, along a stretch of 2.8 kilometers. Plant data from each reproductive phase were collected and analyzed descriptively. The study identified 13 plant species categorized into two population structure types: 1. Pyramid-shaped population structure with a wide base, which includes: *Casuarina equisetifolia* L. *Soneratia alba* L., *Mangifera indica* L., *Hisbiscus tiliaceus* L., *Cerbera manghas* L, *Barringtonia racemosa* Roxb, *Crataeva nurvala* Buch.Ham., and *Sonneratia caseolaris* L. and the pitcher-shaped population structure is owned by the species *Alstonia scholaris* LRBr., *Cocos nucifera* L., *Ceiba pentandra* Gaertn., *Mangifera casturi* Kosterm, and *Areca Chatechu* L.

The findings from Stage 1 then informed Stage 2, which involved the development and prototyping of a Popular Scientific Book (BIP). The cover and table of contents of the compiled BIP are presented in Figure 2.

DAFTAR ISI

Halaman Judul	i
Karya Cipta	ii
Prakata	iii
Kata Pengantar Editor	v
Daftar isi	viii
Daftar gambar	ix
Daftar Tabel	xiv
Sinopsis	xv
Sekilas Tentang Struktur Populasi	1
Mengenal Sungai Aluh Aluh	10
Struktur Populasi Tegakan Bantaran Sungai Aluh Aluh	15
Alstonia scholaris L.R.Br.	20
Areca Chatechu L.	25
Barringtonia racemosa Roxb.	30
Casuarina equisetifolia L.	36
Cerbera manghas L.	42
Ceiba pentandra Gaertn.	48
Cocos nucifera L.	53
Crataeva nurvala Buch.Ham.	57
Hisbiscus tiliaceus L.	62
Mangifera indica L.	68
Mangifera casturi Kosterm.	73
Soneratia alba L.	77
Sonneratia caseolaris L.	81
Faktor Lingkungan Penentu Struktur Populasi	85
Glossarium	90
Daftar Pustaka	95
Biografi Penulis	100

viii

Figure 2. Cover and table of contents

After the Popular Scientific Book was completed into Draft 1, it was then tested to determine its validity and practicality. The subjects of the study were 3 experts, namely lecturers of the biology education study program, FKIP ULM as reviewers of the Popular Scientific Book and 9 students who had taken the plant ecology course as test subjects, namely 3 people for the readability test and 6 people for the practicality test. The object of the study was a popular scientific book made based on the results of field research on the Population Structure of Standing Trees on the Banks of the Aluh-Aluh River, Simpang Warga Village, Banjar Regency. The results of the validity, readability and practicality tests of the Popular Scientific Book are as follows:

Validity of BIP Population Structure of Standing Trees on the Banks of the Aluh-Aluh River, Simpang Warga Village, Banjar Regency

The results or initial development products or draft BIPs were tested by three experts on the content to obtain validity data for the developed BIP. Based on the assessment results of the three experts , there were suggestions for improvements that must be made by the researchers. These suggestions were; The cover should be made more attractive by displaying photos of the main research objects, the letters should be enlarged, the images should be made clearer, the statements to foster critical thinking should be made clearer, and the glossary should be more complete . After revisions were made to the suggestions given by the three experts, the validation values were obtained as presented in Table 1. Based on the assessment results carried out by three experts on the developed BIP on the content, presentation of materials, and language, the results were obtained as presented in Table 1.

Table 1. Expert validation results of BIP content

	Indicator Evaluation	Average Score Evaluation
1. Aspect Eligibility Contents		
A	Compliance material withCPL, CPMK, and sub CPMK	3.8
B	Accuracy of material	3.7
C	Supporting material learning	3.7
D	Updates material	3.8
2. Aspect Eligibility Presentation		
A	Technique Presentation	3.8
B	Supporters Presentation	3.9
C	Presentation of Learning	3.0
D	Serving Equipment	3.8
3. Aspect Language		
A	Straightforward	3.3
B	Communicative	3.7
C	Dialogic And interactive	4.0
D	Compliance with levelparticipant development educate	3.7
E	Collapse and integration channel think	3.7
F	Use term symbolor icon	3.3
	Average	**3.7**
	%	**92.05**
	Category	**Very Valid**

Based on assessments conducted by three expert validators focusing on content, material presentation, and language (as shown in Table 2), the BIP received an average score of 3.7, or 92.5%, which categorizes the product as "Very Valid". These results indicate that the BIP is structurally and procedurally suitable for use in the Plant Ecology course as enrichment material to support the development of students' critical thinking skills. This validation process aligns with Plomp & Nieveen (2010), who emphasize that book validation should involve experts to ensure content accuracy and relevance. As stated by Sugiyono (2012), rational assessments are based on reasoned evaluation prior to field testing. The developed BIP includes essential components such as a clear design, well-described material, relevant visuals, simple and accessible language, critical thinking prompts, and detailed explanations of the population structure of local plant stands. These features contributed to the product receiving a very valid rating, making it suitable for use in tertiary education, as outlined by BSNP (2014)—which states that complete components are a prerequisite for teaching material to be considered valid.

This is further supported by Putri et al. (2020), who stated that validity is a measure of how well a learning resource reflects what it aims to teach. According to Arikunto (1999: 65), teaching materials have high validity if there is alignment between the content and the intended criteria. Ensuring content validity requires the clear definition of the measurement domain during instrument development. As noted by Hera et al. (2014), when experts use a clearly defined measurement framework to evaluate materials, the results can demonstrate that the developed teaching resources are of high quality and ready for use. Validation by experts is therefore essential to identify weaknesses or areas for improvement, especially regarding relevance, accuracy, language, and instructional design. Feedback from expert validation plays

a key role in enhancing the BIP product to better meet educational needs. This is consistent with findings from Dharmono et al. (2020), who emphasized the importance of validation in developing a Swamp Plant BIP aimed at improving students' critical thinking. Similarly, Zaini et al. (2020) highlighted the need for validation when creating student worksheets on microbial concepts in the context of urban wetlands, especially at the high school level.

Practicality BIP Population Structure of Standing Trees on the Banks of the Aluh-Aluh River, Simpang Warga Village, Banjar Regency

The development results or products that have been declared valid by experts were then followed by main product testing to obtain data on the practicality of the developed BIP. This was carried out through a readability test involving 3 students and a practicality test conducted by observers. This step was implemented in accordance with Fauziyah & Herman (2020), who stated that involving readers in the validation process can provide valuable feedback to enhance the quality of popular scientific books. The results of the BIP readability and practicality tests are presented in Table 2 and Table 3.

Test Readability

The results of the BIP assessment developed were tested by users or tests readability to student amount to three person which covering aspect appearance and presentation BIP presented in Table 2.

Table 2. BIP Readability Test Results

	Statement Items	Flat- flat
1)	Every the part studied easy understood	4
2)	Overall complete BIP contents	4
3)	Words used easy understood	4
4)	Quality picture good and can understood It means	3.7
5)	Error type or grammar is not found	3.3
6)	The photo on the cover is clear and can be understood it means	3.7
	Average Score	**3.8**
	%	**94.4**
	Category	**Very good**

Based on the results of the assessment carried out by three students on the BIP developed in the readability test the average score obtained is 3.8 or 94.4 % which means the development product is included in the Very Good category. The assessment results show that the BIP developed according to students can be used very well in learning the Plant Ecology course as enrichment material.

Practicality Test

The results of the assessment of the practicality of the developed BIP which was carried out at the testing stage products for 6 students, the data obtained is as presented in Table 3.

Table 3. Results test practicality BIP

	Statement Items	Average
1)	Easy content studied and understood	4
2)	Material learning interesting for studying	4
3)	I can read text inside teaching materials with easy Because type and size selected letters appropriate	4

4)	I like overall display on teaching materials because own composition matching color	4
5)	I can understand material with help images that have good quality	4
6)	Time provided for studying BIP is enough	3.5
7)	How to teach BIP is not Once implemented previously	3.7
	Average Score	**3. 9**
	%	**97**
	Category	**Very Practical**

Based on the practicality test conducted with students, the average score was 3.9, or 97%, indicating that the developed Popular Scientific Book (BIP) is categorized as "Very Practical." This evaluation suggests that the BIP is user-friendly and highly suitable for enhancing the Plant Ecology course as enrichment material. The practicality of the product development is evident from the results of both the readability and practicality tests (Tessmer, 2014). According to Borg & Gall (2003), practicality evaluation involves obtaining feedback from target readers to determine whether the book is easy to use and meets their needs.

The readability of the BIP significantly influences students' independent learning processes and provides opportunities to enhance their learning experiences. Hayati (2022) emphasized that readability is determined by factors such as language, sentence structure, paragraph organization, and typography, including font size, line spacing, and text width. This indicates that the readability test plays a crucial role in assessing the components of the Popular Scientific Book (BIP). Specifically, readability tests help determine how effectively information can be understood by readers, as important and beneficial information may be ineffective if not comprehensible.

The study results indicate that the developed BIP falls into the "Very Good" category. This demonstrates that the teaching materials are engaging and appropriate for students' learning conditions. Furthermore, the BIP aligns with students' characteristics, allowing them to engage in self-directed learning, thereby enhancing their learning experience. Dick & Carey (2001) stated that readability tests are conducted to identify potential errors such as weak grammar, incorrect spelling, punctuation mistakes, and unclear instructions. These tests also focus on intrinsic criteria like material organization, ease of use, attractiveness, and student satisfaction.

The results of the readability test revealed that three students expressed strong interest in using the developed BIP and found it very good or practical for learning Plant Ecology. Although minor revisions were suggested based on student feedback, this indicates that the BIP is easy to understand and utilize in Plant Ecology lectures. This aligns with Sugiyono's statement (2012), which suggests that design revisions are made to address weaknesses and deficiencies in product design based on expert validation results. Goldman et al. (2024) also highlighted that revisions and editing play a significant role in improving the quality and readability of manuscripts.

Further discussion on the practicality test relates to the integration of the BIP with the learning activities students undertake. The practicality test aims to identify areas that require revision from the perspective of users or readers. This is in accordance with Fitriani et al., (2023), who stated that individual testing (one-to-one evaluation) is a means to assess the practicality of a product, where users provide responses and evaluate the provided products to ensure they align with real-world conditions. Aligning the book with the level of practicality is crucial, as this can influence the user's or reader's interest and motivation to read and learn the material contained in the book (Ummah et al., 2021).

According to Dharmono et al. (2019), a product is considered practical if it is easy to use by both students and educators and offers more content than standard student textbooks. This aligns with the development of this Popular Scientific Book (BIP), as it is easy to understand and use. Practicality means ease of use, and a product is classified as practical if the learning resource can be used efficiently by both educators and learners in terms of time and effort (Zahro et al., 2024). The practicality test results were achieved due to several advantages of this BIP. One of them is the inclusion of real examples of population structures from areas familiar to students and the local community. This is consistent with Millianton et al. (2021) and Putri et al. (2024), who stated that the practicality of a popular science book can be enhanced by including real-life examples that are relevant to everyday experiences. In addition, this Popular Scientific Book includes practice questions based on critical thinking skills, in line with Anggraini et al. (2022), who noted that including exercises and evaluation questions in a popular science book helps readers assess their understanding of the material. Moreover, the BIP has the potential to provide its own impact and benefits. It is expected to serve as a reference in educational activities—whether in schools, universities, or environmental awareness programs in communities. This is due to the nature of the book, which is simple and easy to understand, making it accessible to a broader audience (Dharmono et al., 2022).

CONCLUSION

In conclusion, the validity of the developed BIP received a score of 92.05% from three validators, placing it in the "Very Valid" category. This indicates that the BIP is structurally and procedurally suitable for use in the Plant Ecology course as enrichment material. The readability score of 94.4% places it in the "Very Good" category, suggesting that students find the BIP engaging and appropriate for their learning conditions. The practicality score of 97% categorizes it as "Very Practical," demonstrating that the BIP is user-friendly and highly suitable for enhancing the Plant Ecology course as enrichment material.

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