





# Article Ghost Workers Syndrome and Service Delivery in Nigerian Public Service

#### Orluchukwu Godwin<sup>\*1</sup>

- 1. Department of Public Administration, Faculty of Social Sciences, University of Port Harcourt, Rivers State, Nigeria
- \* Correspondence: gorluchukwu@yahoo.com

Abstract: The problem of ghost labour is undoubtedly a financial burden on the government. Government service delivery in the public sector has suffered as a result of the presence of ghost workers on government payrolls. Governments at all levels must manage their resources wisely in light of the declining revenue brought on by the volatility of the oil price on the global market in order to start projects that will benefit the citizens' socioeconomic growth. Nonetheless, the government has the option of monitoring the phantom workers' operations in order to reroute the money recovered to services that will benefit the general population. The study's goals are to identify the factors that contribute to the existence of ghost workers in Nigerian government payrolls, investigate the effects of ghost workers syndrome on service delivery in the country's public sector. The study used a participative approach and qualitative research as primary methods for gathering and analyzing data. Among other things, the study found that government payrolls contain phantom personnel, which has a detrimental effect on the quality of services provided by Nigeria's public sector.

Keywords: Payroll, Ghost Workers, Fraud, Public Service, Corruption, Biometrics

#### 1. Introduction

Ghost names are allegedly a widespread form of payroll fraud throughout the federal, state, and local administrations of numerous countries, including Nigeria. Payroll operators are known to illicitly influence payroll systems across all three levels of government by infiltrating them with bogus identities to acquire personal wealth. The Nigerian federal government recently identified the misallocation of billions of Naira in payments to fraudulent employees through biometric software. Ghost worker fraud is prevalent in the public sector, with large firms exploiting it to mislead the government and acquire salaries and other unmerited benefits through deliberate misrepresentation of identities. The government seldom encounters challenges in identifying and eradicating these fictitious identities from payrolls without employing contemporary forensic and biometric technologies. Numerous countries, especially those that are less developed, contend with payroll fraud. Numerous emerging nations are currently apprehensive over wage disclosures within the public sector. The problem has escalated into a national crisis that is significantly damaging the economy. Billing the government via fictitious employee

Citation: Godwin, O. Ghost Workers Syndrome and Service Delivery in Nigerian Public Service. American Journal of Social and Humanitarian Research 2025, 6(5), 832-839.

Received: 14<sup>th</sup> Apr 2025 Revised: 20<sup>th</sup> Apr 2025 Accepted: 26<sup>th</sup> Apr 2025 Published: 3<sup>th</sup> May 2025



**Copyright:** © 2025 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license

(https://creativecommons.org/lice nses/by/4.0/) accounts constitutes a substantial portion of continuous expenditures in a nation where personnel expenses represent 40% of total recurrent costs. Over the years, the malaise has evolved into a substantial affliction, posing a significant threat at all levels of government and resulting in extensive financial losses totalling billions of dollars. Payroll fraud poses a significant issue for numerous countries globally, particularly those that are less developed.

Salary discrepancies in public services have emerged as a significant issue for numerous emerging countries. A significant issue afflicting Nigeria's public service is the prevalence of phantom workers. The issue has escalated into a national crisis and significantly burdens the national economy. In a country where personnel expenses account for forty percent of the government's total recurrent spending, the fraudulent inclusion of ghost workers forms a significant amount of these costs. Over time, the sickness has evolved into a substantial affliction that remains a significant threat to all tiers of government, leading to substantial monthly wage disbursements amounting to billions of Naira to fictitious personnel. The Nigerian public service has incurred substantial financial losses from payroll theft for decades. The phenomenon, referred known as "ghost workers," has been examined through many methodologies; yet, its instigators continually devise novel tactics. There is a revitalised commitment to tackle the issue across all governmental tiers, both federal and state, especially in response to the economic recession, the quest for transparency, and the onset of the President Muhammadu Buhari administration. Payroll embezzlement in Nigeria has existed since the inception of the nation's civil service, as stated by Faustinus. Policy planners have been focused on the trend of government expenditure of millions of taxpayer money in the pursuit of fraudulent identities that are becoming prevalent. The issue persists after multiple efforts to eliminate these names.

Africa's largest economy and foremost oil producer has historically been hindered by corruption and mismanagement, exacerbating the impact of a sharp decrease in global petroleum prices. The administration has sought to curtail government expenditures rather than eliminate employment to tackle Nigeria's most significant economic problem in years since President Muhammadu Buhari assumed office last year, pledging to combat corruption. Annually, the public sector incurs losses up to billions of Naira as a result of fraud. This represents only the quantity that has been uncovered and disclosed. Undisclosed losses can indeed total significantly greater or substantial amounts. The issue of ghost labour in Nigeria presents a substantial financial strain on the government, akin to other forms of corruption. It might be contended that ghost workers represent a developmental challenge rather than merely a corruption problem in instances where they have become rampant. In Nigeria, "ghost workers syndrome" denotes a prevalent practice wherein government payrolls include fictitious employees, resulting in substantial financial losses for the public treasury due to salary disbursements to non-existent workers, adversely impacting the quality of public service delivery through fund misallocation and hindering essential government operations. Essentially, it constitutes a form of payroll fraud that misappropriates public revenue by incorporating fictional employees into the payroll. Individuals receiving government revenue without employment or potentially without existence are referred to as "ghost workers" in the public sector; their remuneration is instead disbursed to another party.

Leyira and Temple, in their work with Oguzierem, Sori, and Okodudu, identify nonapparent ghost workers alongside traditional ghost workers, which consist of fictitious personnel added to the payroll by payroll administrators. This form of ghost worker fraud entails genuine public sector employees receiving fraudulent payments due to payroll discrepancies. They encompass employees who obtain unearned salaries through deceitful practices, including those holding multiple civil service positions, receiving multiple salaries under fictitious identities, obtaining compensation or benefits surpassing their rank, remaining on temporary leave or absence while still receiving full salary, or being transferred or retired yet retaining their names on the payroll. The phenomenon of ghost workers extends beyond salary payrolls, since numerous individuals identified as ghost workers are automatically enrolled in the pension plan, while further ones are incorporated by pension payroll administration. The matter is so grave that numerous government parastatals' pension schemes allocate substantial funds to identify the culpable parties.

# 2. Materials and Methods

Ghost workers in the civil service are characterised by the World Bank as personnel who appear on the payroll, get salaries, yet whose actual presence cannot be substantiated. These individuals were never formally acknowledged as employees but have either deceased, retired, or exited public service. They are fraudulent entities whose remuneration is appropriated by others. They are name variations in which an individual receives two or more salaries. The term "ghost worker fraud" denotes instances where an actual or fictitious employee receives compensation without performing labour, or where individuals adopt deceitful tactics to obtain unwarranted and undeserved remuneration. In addition to traditional ghosts, there are non-apparent ghosts, which are fictitious and nonexistent employees that payroll managers include in the payroll. This form of ghost worker fraud entails genuine public sector employees receiving fraudulent payments due to payroll discrepancies. These individuals encompass employees who obtain unmerited salaries through deceitful practices, including those who occupy multiple civil service positions, receive dual or multiple salaries under various aliases, obtain compensation or benefits surpassing their rank, remain on temporary leave or absence while still collecting their full salary, or are in the process of transfer or retirement yet maintain their names on the payroll. Diasporan ghost workers refer to individuals who are legally employed yet have absconded and fail to report for duty. Many of them own additional sources of money beside their employment. In conspiracy with an insider, they utilise electronic payments to obtain their remuneration and perks [9]. Consequently, any form of employee impersonation that impacts the government's wage expenditures is classified as ghost worker fraud.

It encompasses all employees who file salary claims from government money that are illegal, unauthorised, ineligible, fraudulent, nonexistent, or who have evaded responsibility. Individuals receiving government revenue without employment or possibly lacking existence are referred to as "ghost workers" in the public sector; their remuneration is instead disbursed to another party. The World Bank defines civil service ghost workers as personnel who appear on the payroll and get remuneration, however whose physical presence cannot be substantiated. These individuals were never formally acknowledged as employees but have either deceased, retired, or exited public service. They are fraudulent persons whose salary are appropriated by others [10]. Consequently, ghost workers are fictitious employees whose identities appear on the payroll and who receive compensation. Payroll managers jeopardise retaining ghost employees on the payroll if they delay the removal of their names. Payroll clerks occasionally include the names of fictitious or former employees on the payroll, forge their signatures, and appropriate their salaries..

## 3. Results

A ghost worker is an individual recorded on the payroll system who does not genuinely perform duties for the organisation, as stated by the Association of Certified Fraud Examiners. This ghost worker could either be a fictitious individual created by a deceitful employee or a legitimate person who is either consciously or unknowingly included on the company's payroll. Moreover, they elucidated that ghost worker fraud is often perpetrated in organisations with extensive personnel, particularly when employees are geographically distributed through field administration, thereby rendering payroll operations less susceptible to such fraud. Employees who quit, take a leave of absence, or pass away are classified as separated staff members, despite continuing to receive compensation. Occasionally, "ghost workers appear for short durations and vanish for the majority of the time to engage in private pursuits during their designated government work hours" [12]. A public service is defined as any body within the government's framework that implements policies, administers programs, and delivers services to residents. The public service encompasses the civil service. Due to its provision of direct assistance to the executive branch of government, it is often termed the "core" service. Civil servants are officials within ministries and extraministerial departments, whose recruitment and promotion are determined by the Federal Civil Service Commission and the Federation. Conversely, public service or public bureaucracy is often termed the "enlarged" service, as noted by Shimawua.

It comprises numerous functions that are not included in the primary civil service, such as the judicial service.

Office of the Head of the Civil Service of the Federation. i. Entities in which the Government or its agency possesses a controlling stake or interest. ii. Judicial Service Commission, and cetera.

A public service is any body inside the government's framework that implements policies, administers programs, and delivers services to residents. The public service encompasses the civil service. Due to its provision of direct assistance to the executive branch of government, it is often termed the "core" service. Civil servants encompass officers in ministries and extra-ministerial departments, whose recruitment and promotion are determined by the Federal Civil Service Commission and the Federation. They comprise: i. The armed forces (army, navy, air force) ii. The national (or state) assembly services Public Service. iii. The law enforcement agency and additional security organisations.

Government-owned parastatals and agencies, encompassing regulatory bodies, educational institutions, research organisations, infrastructure agencies, statutory entities, and additional service providers, are established by National Assembly Acts. Among the various primary agencies of the Federal Public Service is the Federal Civil Service Commission.

#### National Assembly Service Commission

Significant Effects of Ghost Workers Syndrome on the Nigerian Public Sector: Monetary Depletion: The most detrimental consequence is the substantial depletion of public finances—billions of Naira annually—resulting from salaries disbursed to fictitious individuals, hence hindering the delivery of vital government services and programs.

Reduced Service Quality: The allocation of funds to fictitious labour results in diminished financial resources for infrastructure development, healthcare, and education, among other essential public services.

Corruption and Inefficiency: The employment of ghost workers often involves collusion between public officials and individuals who benefit from the fraudulent payroll system, hence perpetuating corruption within the public sector.

Restricted Employment Opportunities: For qualified individuals seeking positions in the public sector, the inflated payroll resulting from ghost workers may constrain genuine job prospects.

The prevalence of ghost workers undermines public trust in the government's ability to handle resources effectively, potentially fostering cynicism towards public service.

Factors Contributing to Ghost Worker Syndrome: Inadequate Accountability Mechanisms: The creation and maintenance of ghost worker entries on the payroll is facilitated when government entities possess inadequate verification methods and internal controls.

Political Patronage: To enable individuals in power to include their associates on the payroll, ghost labourers are sometimes incorporated. Suboptimal Data Management Obsolete payroll systems and inadequate record-keeping facilitate the creation and maintenance of entries for phantom employees.

Measures implemented by the government to monitor the operations of phantom employees in Nigeria. The Integrated Personnel and Payroll Information System (IPPIS) was implemented by the Nigerian government to streamline payroll processes and identify potential ghost workers through unified data and biometric verification. Examinations and Evaluations: The government has instituted regular audits and investigations by anticorruption agencies, including the Economic and Financial Crime Commission (EFCC) and the Independent Corrupt Practices and Other Related Offences Commission (ICPC), to identify and prosecute individuals involved in the creation of ghost workers.

Campaigns for Public Awareness: To deter individuals from participating in such operations, governmental entities at all levels have heightened awareness regarding the adverse impacts of the "ghost workers" phenomenon in Nigeria.

The Operations of Phantom Employees and the Financial Deficits in Ten States. In 2024, the Independent Corrupt Practices and Other Related Offences Commission (ICPC) recovered almost N20 billion in pension deductions from fictitious employees' salaries. ICPC Chairperson Musa Aliyu made this statement during a breakfast meeting with select members of the Nigerian Guild of Editors in Abuja. Mr. Aliyu stated that the commission also apprehended several individuals proficient in enrolling their acquaintances onto the federal government payroll. He contends that, while pension deductions for employees are remitted to the Pension Fund managers, this does not apply to ghost workers. No Pension Fund Administrator shall accept any deductions attributed to fictitious employees. The N20 billion that was retrieved will remain in limbo. The funds have been monitored and retrieved, and we have also identified individuals responsible for bringing fictitious employees into the system. We discovered that an individual had included his in-laws, spouse, and child on the payroll. He is a fifteen-year-old boy. We apprehended him. The chairperson revealed that in 2023, the panel successfully thwarted the diversion of about N50 billion by certain public officers. He asserted that the antigraft agency has enacted steps to combat corruption and solicited the media's support in achieving the commission's objectives. He asserted that the commission was exerting all efforts to achieve its objective and would neither suppress information nor compromise enforcement. "We will ensure the dissemination of accurate information through reports, newsletters, and press releases on our website and social media platforms as we establish authority concerning the enforcement issue." We unveiled the Strategic Action Plan 2024-2028 at an event last year. The National Anti-Corruption Strategy is consistent with our strategic action plan. The Chairperson contended that the nation's regulations have to be reassessed to mitigate corruption. He stated that, unlike in certain countries, an individual convicted of corruption should not benefit from it. Mr. Aliyu asserts that such individuals should be barred from public service for a maximum of ten years and compelled to remit the total debt, including interest, to public funds. He asserted that the foundation of social degradation in Nigeria was the glorification of corrupt persons and urged Nigerians to cease this practice. Through the established reciprocal relationship with the media, he pledged to transform the commission into one of the premier anti-corruption organisations in the nation. Our partnership with the Nigerian Institute of Public Relations (NIPR) and the Nigerian Union of Journalists (NUJ) has markedly improved our public engagement and anti-corruption communication efforts.

#### 4. Discussion

A few years ago, thousands of ghost workers cost the Federal Government and ten other states more than N538 billion. Between September 2013 and May 2015, 103,000 ghost workers received N220 billion from the Federal Government. Ten of the federation's states contributed the remaining N318 billion. They include Katisna (N30 billion), Kano (N17 billion), Rivers (N60 billion), Benue (N10.2 billion), Oyo (N18 billion), Abia (N26.5 billion), Adamawa (N20.4 billion), Akwa-Ibom (N15 billion), Bayelsa (N120 billion), and Ekiti (N1.2 billion). According to a breakdown of the total, N170 billion, or 60,000 ghost workers, were saved during the previous government of President Goodluck Jonathan, while the remaining N50 billion, or 43,000 ghost workers, were saved. When Jonathan's administration put the Integrated Personnel Payroll and Information System into place, N45 billion was saved between September 2013 and May 2015.One of the Federal Government's programs, the IPPIS scheme, was created to handle human resource management tasks from hiring to firing, including processing payroll and pensions. Additionally, it makes planning easier, helps with budgeting, keeps track of staff emoluments each month against the budgeted amount, guarantees database integrity, makes storage simple, and makes it easier to update and retrieve personnel information for administrative and pension procedures. Similar to this, Dr. Ngozi Okonjo Iweala, the former Finance Minister, announced that individuals who stole from the government payroll by using ghost workers had been referred to the Independent Corrupt Practices and other Related Offences Commission for additional investigation and potential prosecution [14]. She claimed that by eliminating 60,000 ghost jobs, the government was able to save over N170 billion. She added, "We are prepared to support ICPC on any issue that borders on transparency, and the ministry wrote to ICPC to trace those that needed to be held accountable. "Similarly, the Finance Minister established a Continuous Audit Team, led by Mr. Mohammed Dikwa, to examine the government's payroll. Dikwa informed the finance minister that 43,000 phantom workers had been cut from the government payroll a few months into the job. "We have saved approximately N50 billion since we started the continuous audit program, and over 43,000 ghost workers have been removed from the federal government's payroll," Dikwa stated . Public resources were depleted by ghost workers in Rivers State. Some of the recently identified ghost workers in the state have started returning money that was unlawfully collected as pay, according to the Rivers State Government. A source claims that the ghost workers took this step in order to avoid facing state prosecution.

According to Dr. Austin Tam George, Commissioner for Information and Communications, the state government's reinvigorated fight against ghost workers has resulted in monthly recoveries of over N1 billion. Approximately 2,000 ghost workers had also been found, he said. He clarified that Nyesom Wike, the state governor at the time, identified the ghost workers by using the civil servants' Bank Verification Numbers . Following the workers' verification exercise, the Oyo State Government also saved over N300 million. According to a top government official, the panel established to look into employees who were reportedly receiving multiple salaries was still in operation. Abiola Ajimobi, the former governor of the state, warned that individuals responsible for the fraudulent activity will face legal action. Arrests were made after it was found that one of the employees was earning nine wages while another was receiving eleven. The Bayelsa state government's media team noted on May 11 that the state had temporarily removed 16,532 employees' and pensioners' names from its payroll due to their alleged involvement in multiple salary collection, retirement age fraud, and other violations. On May 17, 2016, former Bayelsa State Governor Mr. Seriake Dickson stated on a television show that the state loses over N24 billion every year as a result of payroll fraud. Dickson asserted that the payroll frauds conspired with certain financial institutions to cheat the government[4].

Following a verification of the state government staff, the Ekiti State Government also found that it had been losing more than N17 million per month to ghost workers. The state

Ghost workers cost Katsina State N6 billion a year and N30 billion a few years ago. Following a biometric verification of its personnel, the Kano State Government also found 7,629 ghost workers. Muhammad Na'iya, the state's head of service, stated that the state had saved more than N283.5 million a month by not having to pay the ghost workers since the discovery. According to a report by a biometric audit expert, the state government of Benue State spent more than N170 million a month on paying salaries to 14,000 ghost workers, according to former governor Samuel Ortom. This indicates that the state government has spent N10.2 billion over the past five years and more than N2.04 billion each month on ghost personnel . Following a biometric verification exercise, the state discovered no fewer than 1,800 ghost workers, according to a statement made by Mr. Obinna Oriaku, the former Abia State Commissioner for Finance, on June 13, 2016. He said that the state has successfully reduced its monthly wage cost from N1.5 billion to N1.057 billion as a result of the exercise. 12,609 ghost workers in the state's local government payroll were discovered by the Adamawa State Government. According to Mr. Maurice Vunobolki, the former chairman of the state's Local Government Staff Verification Committee, 12,609 ghost workers have cost the state N341 million a month in wages, or N4.1 billion a year . The Akwa Ibom State Government started a scheme in March 2016 to find and fire ghost workers from its civil service. According to Mr. Akan Okon, the state's former finance commissioner, the administration was carrying out staff audits to make sure the exercise went well. He claimed that by connecting our payroll system to the BVN, the problem of ghost workers in the state would undoubtedly be lessened. To lessen the burden of high wage bills, several governors have taken steps to remove ghost workers off their payrolls. Due to declining Federal allocations brought on by the worldwide oil crisis, the majority of states owe their employees many months' worth of unpaid salaries. Civil staff were verified in several jurisdictions; however other governments have finished biometric verification exercises and have found thousands of ghost workers[15].

According to the Niger State Government, the screening process it started is still going strong and would help identify ghost personnel at the state and local levels of government. Mr. Jide Orintunsin, the former Senior Special Assistant on Media to the Governor, argued that until the exercise was finished, it would be challenging to provide an exact number of phantom workers in the state. Orintunsin attested to the fact that some money had been spared throughout the vetting process. In an effort to identify any phantom workers, civil servants in the states of Imo and Enugu were also put through a verification process. Mr. Callistus Ekenze, the former head of service for Imo State, also said that following verification, the state government would reveal the total amount of money saved. "It (verification) is on course and has not been concluded," Ekenze stated. We won't know how much money the government has saved until we find out how many people are ghost workers. Workers and political appointees in Enugu State were urged to appear before the verification team at the Old Governor's Lodge in the state capital in order to assure the success of the verification procedure .

In Kwara State, the ex-Governor, Alhaji Abdulfatah Ahmed, provided reasons for his state's verification exercise. Then questioned about what influenced his choice to conduct verification prior to salary payments? Ahmed stated, "Naturally, when confronted with the challenges our country and state are experiencing, especially with a significant drop in revenue, the initial action is to reduce expenses, and which costs are we considering? The

expenses associated with governance, overhead, and personnel are well-known, and we all recognize that our various workforces have experienced a history of excessively inflated databases." Therefore, it is completely natural for us to create data that will fit the intended database. "Individuals who have been verified have been requested to receive payment." If someone has any pending payments, it is likely that there are one or two aspects needed to guarantee that you are properly listed. We continue to work on it since it involves more than merely completing the biometrics. This irregularity has persisted for a duration of 15, 20 or even 30 years. Therefore, you cannot simply resolve it all in one swift program.

#### 5. Conclusion

Ghost worker syndrome constitutes a drain on Nigerian economy. From the study, it is clear that governments at all levels have made efforts to stem the tide of corruption occasioned by ghost worker in Nigeria. However, more efforts are needed to combat the menace of ghost workers, if Nigeria must achieve socio-economic development in future. In order to reduce the incidence of Ghost workers in Nigeria, there should be periodic staff audit and culprits should be brought to book. Government at all levels should employ technology, so as to identify these elements that have inflicted economic harm on the people of this great country.

## REFERENCES

- [1] Association of Certified Fraud Examiners, "Ghost employees frauds-payroll frauds," 2016. [Online]. Available: http://www.brisbaneacfe.org/library
- [2] D. Shimawua, "Factors Responsible for 'Ghost Workers' Syndrome in Public Service and its Impact on the Performance of the Sector in Nigeria," Int. J. Sci. Res. Technol. Appl. Sci. Health Stud., vol. 4, no. 1, 2020.
- [3] R. Ogbonnaiye, "Ekiti Loses N19.3 million monthly To Local government Ghost Workers." [Online]. Available: https://dailytrust.com
- [4] N. Faustinus, "Nigeria Civil Service and Salary Fraudster." [Online]. Available: http://www.dailypost.ng/2013/03/03/nwaorgu-faustinus-nigeria-civilservice-and-salary-fraudsters
- [5] Z. Gbemre, "The Ghost Workers Syndrome in Nigeria An Economic Drain that Needs to Be Addressed, Especially in The Niger Delta." [Online]. Available: http://reformeronline.com/the-ghost-workerssyndrome-in-nigeria-aneconomic-drain-that-needs-to-be-addressed-especially-in-the-niger-delta
- [6] M. I. Hossain, "Measuring Effectiveness of Public Expenditures in Bangladesh: A Survey Based Case Study in the Education Sector," Ritsumeikan Asia Pacific University, Japan, Oita Beppu, RWP-13002, 2013.
- [7] "How ICPC recovered N20bn ghost workers' pension deductions in 2024," 2024.
- [8] O. Mike, "The Plague Of 'Ghost Workers': Interrogating Payroll Fraud and Executive-Bureaucratic Conspiracy in Nigeria," J. Policy Dev. Stud., vol. 12, no. 1, 2019.
- [9] N. McCallum and V. Tyler, "Case study 2: international experience with civil service censuses and civil service databases," International Records Management Trust, London, UK, 2001.
- [10] U. A. Oguzierem, S. Joab-Peterside, and Okodudu, "Ghost Workers Fraud in Primary and Secondary Education Sector in Bayelsa State: Beyond Financial Loss," J. Public Adm. Soc. Welf. Res., vol. 2, no. 2, 2017. [Online]. Available: http://www.iiardpub.org
- [11] O. H. Obaze, "Caging Nigeria's Ghost Workers," 2016.
- [12] T. Ojoye, "FG, states spent N538bn on ghost workers in five years," 2016.
- [13] S. F. Wamba, R. Bhagwat, C. Guthrie, and N. I. Shalle, "A performance study of RFID-based supply chain visibility solutions: practice makes perfect?," Ind. Manag. Data Syst., 2017.
- [14] M. Themistocleous and Z. Irani, "Novel taxonomy for application integration," Benchmarking Int. J., vol. 9, no. 2, pp. 154–165, 2002.
- [15] D. Montoya, B. Haegeman, S. Gaba, C. De Mazancourt, V. Bretagnolle, and M. Loreau, "Trade-offs in the provisioning and stability of ecosystem services in agroecosystems," Ecol. Appl., vol. 29, no. 2, p. e01853, Mar. 2019, doi: 10.1002/eap.1853.